



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

MBA PROFESSIONAL REPORT

**A Case Analysis of Energy Savings
Performance Contract Projects
and Photovoltaic Energy
at Fort Bliss, El Paso, Texas**

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June 2006

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**A CASE ANALYSIS OF ENERGY SAVINGS PERFORMANCE
CONTRACT PROJECTS AND PHOTOVOLTAIC ENERGY
AT FORT BLISS, EL PASO, TEXAS**

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A CASE ANALYSIS OF ENERGY SAVINGS PERFORMANCE CONTRACT PROJECTS AND PHOTOVOLTAIC ENERGY AT FORT BLISS, EL PASO, TEXAS

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I. INTRODUCTION

A. PREFACE

This MBA Project reviews existing policy of the Federal Energy Management Program under the purview of the National Renewal Energy Laboratory (NREL) for Energy Savings Performance Contracts (ESPCs). This project assesses the ability for the Department of Defense (DoD) to incorporate emerging technologies in alternative energy to supplement or replace existing power sources for DoD installations within the current Energy Savings Performance Contract policy. The project reviews the history of Energy Savings Performance Contracts, and the statutory laws, regulations, and policy memoranda governing their use. Further, this project conducts a cost-benefit analysis of conventional power versus emerging photovoltaic energy for the U.S. Army Installation Fort Bliss in El Paso, TX. The project analyzes energy demands based on a new force alignment at Fort Bliss in accordance with the recent Base Realignment and Closure (BRAC) findings.¹ The project reviews current Energy Performance Contract Policy and recommends changes to improve the program and allow for the use of emerging alternative energy technologies.

B. RESEARCH OBJECTIVES

1. Provide an overview of the Energy Saving Performance Contract (ESPC) program established under the cognizance of the National Renewal Energy Laboratory.
2. Review existing ESPCs and assess their benefit to the contracting Federal Agencies.
3. Provide a market analysis of commercial solar equipment identifying specifics on emerging technologies, installation, operation, maintainability, and durability.

¹ BRAC 2005 Comes at 'Perfect Time' to Help Army 'Reset', Armed Forces Information Service, Washington, D.C. May 27, 2005. http://www.defenselink.mil/news/May2005/20050527_1387.html, 01 APR 2006

4. Provide a cost benefit analysis of utilizing emerging photovoltaic energy to power Fort Bliss, El Paso, TX.

5. Provide Contracting policy recommendations for the Department of Defense to utilize ESPCs.

C. RESEARCH QUESTIONS

1. Can photovoltaic solar power sufficiently meet the current and probable future additional power requirements of Fort Bliss El Paso TX?

2. Would it be cost beneficial for the DoD and industry to implement an ESPC utilizing photovoltaic energy to power Fort Bliss El Paso TX?

3. Does the existing ESPC program policy allow for small companies with emerging photovoltaic technology to compete for these contract actions?

4. Are the requirements for certification as an Energy Saving Company too onerous on small businesses?

D. THESIS SCOPE

This thesis will briefly look at the history of the ESPC program and the laws and regulations governing ESPC projects. The thesis will review current and past ESPC projects and appraisals of the program by Congress through reports from the General Accountability Office, and the National Berkeley Science Laboratory. The thesis will then turn its focus to Fort Bliss and the installations energy generation requirements. The project will analyze the ability for emerging Photovoltaic alternative energy to provide energy savings at Fort Bliss through an ESPC arrangement. Finally, the project will make recommendations concerning an ESPC project at Fort Bliss and the current ESPC policy's ability to incorporate new emerging alternative energy solutions into ESPC projects.

E. BENEFITS OF THIS STUDY

The Federal Government desperately needs to recapitalize its energy infrastructure. In the current resource constrained environment, appropriated funding alone cannot achieve the capital improvements required to meet energy savings goals set forth in Executive Order 13123. This study will seek to assess the ability for ESPC projects to achieve these improvements utilizing financing methods outside of the normal appropriations process.

The study will look at new emerging Photovoltaic technology, and the ability of this technology to provide energy infrastructure improvements within the DoD leading to measurable savings on installation utility costs. The study will also look at ESPC policy and its ability to incorporate new emerging alternative energy technologies.

F. RESEARCH METHODOLOGIES

The first phase of research determined what legislation and regulation govern ESPC projects. A subsequent review of the General Accountability Office and Ernest Orlando Lawrence Berkeley National Laboratory recently completed comprehensive studies on the ESPCs was conducted. Data on Solar PV technology was obtained from interviews with private industry. Data on energy generation requirements and existing site conditions at Fort Bliss was obtained through discussions with base personnel. These studies and data were used to conduct a cost benefit analysis for implementing PV technology at Fort Bliss through an ESPC project as well as assess current ESPC policy.

G. THESIS ORGANIZATION

This thesis is organized to review the history of the current ESPC program, and assess the use of Photovoltaic technology at Fort Bliss under an ESPC project to offset energy installation energy costs. Chapter I introduces the ESPC program, and addresses questions to be addressed by the research.

In Chapter II, a review of the current ESPC program is conducted. This chapter looks at the history of ESPC legislation, reviews the implementation of the current

program, compares EPSC to traditional services contracting, reviews published documents surrounding the ESPC program, and reviews several ESPC projects implemented within DoD and the Federal Government.

Chapter III reviews Solar Photovoltaic (PV) Energy generation, and discusses newly emerging PV technologies. The chapter also reviews site conditions at Fort Bliss relating to current energy consumption, energy costs, future power generation requirements, and the solar environment.

Chapter IV focuses on the proposed ESPC project at Fort Bliss and conducts a cost benefit analysis to determine the viability of a Photovoltaic ESPC to provide measured energy savings that would benefit DoD while providing an adequate return on investment to an Energy Service Company.

Chapter V takes the findings from Chapter III and IV and provides conclusions to questions presented in Chapter I. Further it provides recommendations to Fort Bliss on a course of action for ESPC implementation and ESPC policy recommendations. The recommendation is based only upon the data as assumed and derived from the limited sources of available information.

II. ENERGY SAVINGS PERFORMANCE CONTRACT PROGRAM BACKGROUND

A. U.S. ENERGY POLICY

Since the oil crisis of 1974, the U.S. has realized the need to invest in energy conservation efforts to minimize the effects of fossil fuel driven energy markets on the U.S. Economy. The recent energy market shocks in oil and natural gas underscore the importance of identifying alternative renewable energy sources.

U.S. Energy policy set forth in the National Energy Conservation Policy Act of 1978 and the subsequent Energy Policy Act of 1992 and 2005 have sought to encourage more efficient use of fossil fuels (including oil, coal, and natural gas) and encourage research in alternative renewable energy sources. Since 1950 overall energy consumption in the United States has tripled.² During that same period, consumption of electricity has increased ten fold.³ While there is little agreement as to the amount of fossil fuels remaining and when these resources will be exhausted, there is widespread agreement that these resources are indeed finite. The United States' energy policy has sought to make continuous measured gains in energy efficiency to stretch dwindling supplies of fossil fuels and gain time to develop technologies for alternative renewable energy.

The Federal Government recognizes it is the single largest energy consumer in the nation, spending \$4B in FY 2000 on nearly a quadrillion BTUs in energy for its approximately 500,000 facilities in the United States. In 1999 Executive Order 13123 mandated all federal agencies to curtail energy consumption by 35% by 2010.⁴ It also set a goal of having 20,000 solar energy systems at Federal facilities by 2010.

President Bush's January 31, 2006, State of the Union reemphasized the need for continued cuts in U.S. energy usage and the need to encourage investment into

² National Energy Policy. Report of the National Energy Policy Development Group, pg xi. May 2001.

³ Ibid.

⁴ Department of Energy. Senate Committee on Appropriations Subcommittee on Interior and Related Agencies Concerning the FY 2004 Department of Energy Budget Request.

identifying alternative sources of energy. The President also set a goal of reducing current dependence on Middle Eastern oil by 75% by the end of the decade.

B. EFFECTS ON DEPARTMENT OF DEFENSE

Within the Federal Government the Department of Defense (DoD) is under tremendous budget pressure to control Operations and Maintenance costs as Personnel and Procurement costs have continued to soar. The DoD spent \$2.8B on energy in FY 2004. The President's FY 2007 Budget has asked for a 7% increase in overall spending, an increase of 48% since 2001.⁵ The vast majority of these increases have gone toward supporting the Global War on Terrorism in Iraq and Afghanistan. Despite these significant increases, the DoD, like most Federal agencies, does not have the requisite discretionary funding to make much needed improvements to the aging capital infrastructure. Therefore, alternative methods of financing may be one tool to achieve the significant gains in energy efficiency as required by Executive Order 13123. Energy Savings Performance Contracts may be one such vehicle to achieve significant energy savings without a large investment of procurement or military construction funds in capital expenditures.

C. ENERGY SAVINGS PERFORMANCE CONTRACTS

The ESPC program was first authorized by the Comprehensive Omnibus Budget Reconciliation Act of 1985. This act amended the National Energy Conservation Policy Act of 1978. The Energy Policy Act of 1992 (EPAAct) further extended Federal Agencies' authority to use ESPCs. The program was established to encourage energy efficiency throughout the Federal Government. The ESPC program, administered by the Department of Energy, under the Federal Energy Management Program recognizes the great expense associated with capital improvements to energy generation facilities. The ESPC is designed to share cost savings with the commercial firms willing to fund capital improvements that lead to energy savings. Commercial firms are certified as Energy

⁵ President's Fiscal Year 2007 Budget. Department of Defense, <http://www.whitehouse.gov/omb/budget/fy2007/defense.html>, 01 APR 2006.

Savings Companies (ESCO) by the Department of Energy or by the Army Corps of Engineers for the DoD. ESPCs can range from small projects in water conservation to large scale efforts resulting in the construction of modern, more efficient power generation facilities. The Energy Savings Company guarantees a fixed amount of energy cost savings to the federal installation over the life of the contract, up to 25 years, and earns a portion of the cost savings. The remainder of the energy cost savings, depending on the Federal agency, is returned to the U.S. Treasury or may remain with the agency. Per Title 10 USC 2865, the DoD is authorized to retain all energy savings. The net savings is to be divided evenly for use on additional energy conservation measures and improvements on the installation from which the savings were generated. The installation commanding officer has discretion over the use of installation funding for military housing, minor construction or for MWR.⁶

The ESPC program under the Energy Policy Act of 1992 expired in September of 2003 but was extended in October of 2004 to expire in October, 2006. The Energy Policy Act of 2005 signed in August, 2005 further extended the Energy Savings Performance Contract program until October, 2016.

D. DOE PROGRAM ADMINISTRATION

The Energy Savings Contract Program is managed by the Federal Energy Management Program (FEMP) under the Office of Energy Efficiency and Renewable Energy at the Department of Energy. The Federal Energy Management program under the Energy Policy Act of 1992 was required to set regulations for the use of ESPCs and perform oversight in the form of Energy Audits.

The FEMP has set forth procurement procedures for ESPCs and selection of Energy Savings Companies under 10 CFR 436 that take precedence over Federal Acquisition Regulations. The FEMP is also charged with providing technical assistance and training to all Federal agency procurement executives on the ESPC program.

⁶ USC Title 10 Subtitle A Part IV Chapter 169 Subchapter III 2865

E. DOD PROGRAM ADMINISTRATION

The Defense Energy Program Policy Memorandum 94-2 designated the U.S. Army as the lead agency within DoD for the implementation of Energy Savings Performance Contract procurement procedures. As the lead agency the Army is responsible for prequalification of Energy Savings Companies for use on DoD contracts. The Army is also responsible for providing assistance to other DoD agencies in negotiating and awarding ESPC contracts and creating Super ESPC indefinite delivery indefinite quantity contracts to streamline ESPC acquisition procedures. A Super ESPC's goal is to streamline the ESPC process by awarding IDIQ contracts to pre-qualified Energy Savings Companies. Super ESPCs cover a broad range of Energy Conservation Measures from Water Conservation to HVAC improvements. Projects are definitized at the issuance of a delivery order, streamlining the solicitation and award process. Finally the Army is required to review oversight procedures for ESPCs and sit on the DOE ESPC steering committee that proposes recommendations and changes for the ESPC program.

F. OVERSIGHT

The Federal Energy Management Program under the DOE requires an Energy Audit performed on 10% of all Energy Savings Performance Contracts each year. The Energy Audit is in addition to the routine contract administration functions. The Energy Audit is a comprehensive review of the installation's energy requirements and the effects of the ESPC to determine the ability to meet cost and energy savings goals.

G. ESPC STRUCTURE

The structure of the ESPC is determined by the Federal agency to achieve shared energy savings among the agency and the contractor. ESPCs established since the Energy Policy Act of 1992 have largely taken the form of leases. Contractors have privately financed a capital investment resulting in energy savings and received government lease payments from the realized energy savings.

The goal of an ESPC is provide energy efficiency to the Government with no capital investment by the Government. Capital Improvements leading to achieving energy efficiencies are financed by Energy Savings Companies (ESCO) that guarantee energy savings to a Federal installation. The ESCO recovers the cost of the capital investment only by earning payments out of the guaranteed savings. If no savings are achieved the Capital Investment is lost. The ESCO is responsible for the evaluation, design, financing, acquisition, installation, and maintenance of the energy saving equipment during the life of the ESPC. The ESCO will only be compensated for actual, measurable savings. Therefore the contracting agency and contractor must jointly establish an energy baseline. The complexity of measurement will coincide with the complexity of the project to be completed. Changes in energy demand as a result of changes in population, weather, and other factors must also be addressed. ESPCs require annual audits to verify savings and accuracy of payments. Payments for ESPCs are made from the Federal installation's annual utility account and related operations and maintenance account. Aggregate payments for utilities and ESCOs cannot exceed the amount the installation would have paid for utilities and routine maintenance in the absences of the ESPC. The figure below illustrates the potential effect of an ESPC on an agency utility budget.

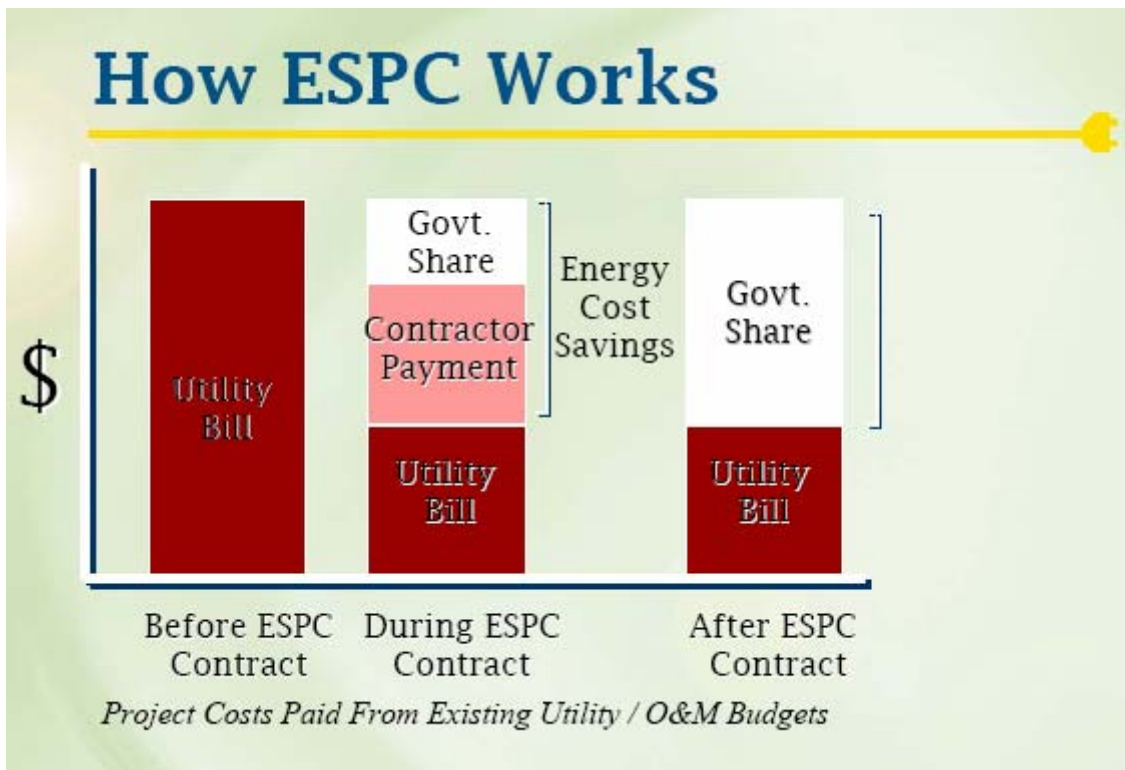


Figure 1. FY 2005 FEMP Two Ways to Alternatively Finance Energy Projects
 (From http://www.eere.energy.gov/femp/energy_expo/2005/pdfs/f_s5a.pdf)

Federal Agencies can enter into ESPCs from unsolicited proposals from ESCOs as long as the agency provides an opportunity for competing qualified ESCOs to submit competing proposals. DoD ESPCs will be conducted in accordance with the Federal Acquisition Regulations and Defense Federal Acquisition Regulations.

H. CERTIFIED ENERGY SAVINGS COMPANY (ESCO)

To participate in an ESPC, a contractor must be a certified as an Energy Savings Company (ESCO). Certification as an ESCO is conducted for the DoD by the lead agent on ESPCs, the Department of the Army. The certification process the Army utilizes mirrors the DOE ESCO certification process. The certification process requires submission of a statement of qualification that reviews the experience of contractors and their ability to perform proposed ESPCs. ESPCs are long term, stretching as long as 15 to 25 years. As such, a robust vetting process needs to ensure the Contractor is capable

of completing capital improvements and that the contractor is a going concern that will be able to complete the extensive period of performance.

Annually, the Army will solicit for firms requesting prequalification for future ESPC contracts. Contractors that have been competitively selected by regulated public utility companies to provide Energy Savings Performance contracting services will automatically be considered pre-qualified. Firms will submit a statement of qualifications. The statements are reviewed by a Qualification Review Board that represents each service. Once approved contractors are pre-qualified for a period of one year and the lists are promulgated to all DoD agencies.

I. SUPER ENERGY SAVINGS PERFORMANCE CONTRACTS

Super ESPCs are Indefinite Delivery, Indefinite Quantity contracts that have been awarded by the Department of Energy, and other Federal Agencies delegated this authority by DOE through the Federal Energy Management Program. Within the DoD, the U.S. Army and Air Force have been delegated this authority and have awarded Super ESPCs.

The purpose of a Super ESPC is to allow Federal agencies to participate in ESPCs without having to rely on organic contracting personnel to complete the full requirements of structuring a new ESPC. Super ESPCs are awarded with certified Energy Savings Companies and include a myriad of services which may be provided. Services as widely varied as photovoltaic to water conservation equipment may be contracted for through writing a task order off an existing IDIQ contract.

There are several benefits to using a Super ESPC. The time required to structure a request for proposal, issue a solicitation, conduct negotiations, and process an award are greatly reduced. The structure of a Super ESPC is already in place. Due to the relative early stages of the ESPC program the experience in drafting the contracts for these actions is limited. Super ESPCs remove this administrative burden on organic contracting personnel.

The Super ESPC also periodically recertifies Energy Savings Companies to ensure only qualified companies are awarded Super ESPC task orders. This eliminates the burden on the requesting agency to ensure a company responding to an ESPC Request for Proposal is a qualified Energy Savings Company.

There are potential drawbacks in using a Super ESPC. The structure of a Super ESPC eliminates some of the latitude contracting officers may otherwise have in structuring an ESPC for their specific needs.

Additionally, Super ESPCs restrict the ability of fledgling energy companies with emerging technologies to receive awards. The ESCO certification process arguably eliminates all but the largest of Energy Companies. The process requires a thorough review of previous energy savings projects completed by a contractor. This forces small businesses to team with ESCOs to gain experience and earn any business under a Super ESPC or complete a robust ESCO certification to receive an ESPC not under a Super ESPC IDIQ.

J. COMPARISON OF ESPCS WITH TRADITIONAL ENERGY SERVICE CONTRACTS

To thoroughly understand the structure of ESPCs it is helpful to review the differences between this alternative contracting method and traditional contracting for energy services.

A significant difference as previously discussed is financing. Traditional contracting for services require fully funded upfront appropriations. This is one of the main attractions for the Federal Government looking towards ESPCs as an alternative way of financing projects that the normal appropriations process has failed to support.

Besides financing there are several other significant differences that may appear subtle, but play a significant role in evaluating ESPC project proposals. These differences include assumption of risk, the competitive environment, and contractor profitability and incentives.

The risk associated with traditional services contracting follows a continuum tied largely to contract type. Risk is shared between the government and the contractor. Requirements with significant cost, schedule, and or performance risk due to a myriad of reasons to include emerging technology migrate towards Cost Reimbursement contracts with the government receiving only a contractor's best effort. The government assumes much of the risk as all reasonable, allowable, and allocable costs of the contractor are paid. The government seeks to balance this risk with award or fixed fee arrangements to create incentives for the contractor to control costs. In contrast, well defined requirements with minimal risk tend to use Firm Fixed Price contract arrangements where the contractor assumes much of the risk and after contract award profit is determined solely by their ability to control costs.

Risk under ESPC contracts is largely borne by the Contractor and their Privately Secured Financing companies. If the ESPC contractor fails to achieve energy savings, the government has no obligation to pay for the Capital Improvements. The government does bear some risk as to whether a project will reach completion and risk that the project becomes more costly to operate than the existing infrastructure. If a contractor defaults under these scenarios the government would require significant funding to rescue a project.

However, this risk is mitigated through the requirement of Performance Bonds under the Miller Act 40 USC 3131 and FAR Part 28.102-1. The Miller Act requires all public works projects exceeding \$100,000 to have contractors acquire a surety to insure their performance. If the contractor fails to perform the bond is paid to the government. Given this performance risk mitigation the risk for ESPC projects shifts overwhelmingly to the contractor.

The Competitive Environment is also significantly different between ESPC and traditional services contracting. As previously discussed ESPCs may only be awarded to pre-qualified Energy Savings Companies. Traditional contracting is subject to the Competition in Contracting Act of 1984 which dictates the use of full and open competition with few exceptions. The use of CICA considerably opens up the number of companies eligible to respond to a traditional Request For Proposal for energy services.

This restriction also highlights a shortcoming previously mentioned in ESCO certification. The certification process of ESCOs and the subsequent award of Super ESPCs appear to be overly restrictive. As evidenced by the Western Region Super ESPC ESCO list below, only the largest of Energy Service Companies are certified ESCOs and have been awarded Super ESPCs.

Western Region ESCO Contact List

The Qualification Sheets listed below are available as Adobe Acrobat PDFs. [Download Adobe Reader.](#)

Organization	Primary Contact	Qualification Sheets
Honeywell International, Inc. 999 Broadway Suite 300 Saugus, MA 01906 www.honeywell.com Contract No.: DE-AM36-97EE73567	Alicia Collier Phone: (703) 378-5316 Fax: (703) 378-5326 alicia.collier@honeywell.com	(PDF 134 KB, 3 pp)
Johnson Controls Government Systems, LLC 10289 W. Centennial Road Littleton, CO 80127 www.johnsoncontrols.com Contract No: DE-AM36-97EE73568	Andrew Morton Phone: (303) 932-3795 Cell: (720) 635-6607 Andrew.M.Morton@jci.com	(PDF 123 KB, 2 pp)
NORESCO, ERI Services Division 1 Research Dr., Suite 400C Westborough, MA 01581 www.noresco.com Contract No.: DE-AM36-97EE73566	Michael Beccaria Phone (CT): (203) 335-0266 ext. 111 Fax (CT): (203) 335-2490 Phone (ATL): (770) 395-0342 Fax (ATL): (770) 399-5441 mbeccaria@noresco.com	(PDF 117 KB, 2 pp)
Sempra Energy Services Company	Phillip L. Smith, P.E., CEM	(PDF 128 KB, 2 pp)

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This ESCO policy may be interpreted to be at odds with the Energy Policy Act of 2005 that seeks to encourage the development of new alternative energy technologies. Studies, such as a recent report released by the SBA have shown U.S. technologic innovation is developed not by large established companies but predominantly by small emerging entrepreneurial firms.⁷ Under the ESPC program framework these small firms are all but excluded from competing for these projects.

This exclusion requires small businesses to team with large ESCOs in order to break into the ESPC market. In reality this means an additional cost to the Federal Government as the ESCOs will charge a premium for providing assistance to the small business. Although only a single data point, Sempra Energy Services, a Western Super ESPC ESCO, identified these costs as to be as high as 30% in order to cover overhead and profit.⁸

⁷Eckhardt, Jonathan T. Innovation and Small Business Performance, SBA, Mar 2006.

⁸ Smith, Phillip. Director Federal Project Development, Sempra Energy Services, A division of Honeywell Building Solutions, May 2, 2006.

This leads back to the other fundamental difference between ESPC projects and traditional energy services contracting, profits and incentives. Profit under traditional services contracting can be controlled through contract type, and by applying a weighted guidelines approach.⁹ In contrast, under an ESPC project contractor profit and incentive are a function of verifiable energy savings, capital investment, payback period, private financing rate, and the ESCO's internal hurdle rate. These are not patently obvious at the conception of the ESPC project. Because of the risk assumed by an ESCO, contractors do not enter these arrangements without a high level of confidence in their ability to perform. The assumption of risk to the contractor also comes at a cost, with the Federal Government locking itself into payments for up to a 25 year period. In many ESPC arrangements the Federal Government may be paying well in excess of a reasonable range of profit under traditional financing. There is also a risk that incorporated improvements may become obsolete during the payback period. This is somewhat mitigated by the requirement for the ESCO to continue to demonstrate savings through out the contract term and the ability to incorporate additional ECMs through another ESPC project. This highlights the importance of the government maintaining continued oversight of the energy baseline and inserting a cancellation provision that will allow for early buyout of the capital improvements.

The incentive to perform is largely different under an ESPC versus traditional contracting. While incentives under traditional contracting vary with contract type, they are limited to a relatively short contract term, up to five years with options, in comparison to an ESPC. Under an ESPC the contractor incentive not only to complete a project but also maintain energy savings continues throughout up to a 25-year contract term.

This highlights project maintenance as another difference between Traditional Energy Services contracting versus ESPC projects. Under a traditional contracting the energy conservation measure (ECM) is installed and the Federal Government is responsible for performing or outsourcing the maintenance. Under an ESPC project, the contractor is responsible for the maintenance and has a vested interest in keeping the

⁹ Defense Federal Acquisition Regulations 215.404-4 Weighted Guidelines

ECM in peak performance. The contractor is paid under the ESPC for verified energy savings; if an ECM performance is degraded the contractor suffers. The contractor incurs all costs for maintenance of the ECM.

When contemplating an ESPC project it is important to understand the distinct differences with traditional contracting methods for energy services and how risk, competition, and profitability differ. Appendix B contains Sections B, C, H, and I of the DOE Super ESPC contract let for Geothermal Heat Pump (GHP) energy control measures. This and other Super ESPC contracts serve as framework for conducting an in depth comparative analysis and guidebook for contracting offices in creating a stand alone ESPC.

K. GENERAL ACCOUNTABILITY ASSESSMENT OF ENERGY SAVINGS PERFORMANCE CONTRACTS

At the request of Congress, the Government Accountability Office has investigated the ESPC program, publishing several reports, the latest in June 2005.

The GAO reports identify that during the period from 1999 to 2003, more than 250 contracts were let under the ESPC program for periods up to 25 years. These actions have committed approximately \$2.5 Billion in annual payments contingent on verified energy savings. Not surprisingly, the DoD has the largest portion of these contract actions with more than 150 valued at nearly \$2 Billion in contingent payments. The Federal agencies expect to receive more than \$2.5 Billion or more than 9 million MMBTUs in energy savings over the life of these contracts.

Federal Agencies recognize that these improvements could have been implemented at a lower cost through up front funding for capital improvements. However, the agencies are all in agreement that these projects would have not been funded in a timely manner due to higher funding priorities. An example of this is the U.S. Navy planned for approximately \$125 Million in energy efficiency projects annually, but the entire DoD has received \$50 Million annually from Congress. The agencies expect to receive additional benefits to include shifting performance risk to

Energy Savings Companies, integrating multiple energy efficiency improvements, and eliminating environmental hazards with newer, cleaner technologies.

Federal Agencies indicated the use of ESPCs allowed them to exceed the FY 2000 goal of reducing BTU energy usage by 20% over the 1985 baseline as required by Executive Order 13123. According to agency officials GAO interviewed, the goal would not have been met without ESPCs. DoD officials further stated their FY 2005 energy goals would probably not be met due to the suspension of ESPC authority during 2004. The Department of Defense did not meet its goal of a 30% reduction, achieving only a 28.3% reduction.¹⁰

The GAO found that ESPC projects are significantly more expensive than if the same capital improvements were publicly financed through upfront appropriations. GAO determined the premium to vary from a low of 8% to a high of 56%.

The GAO also found that in many of the projects savings were based on estimates and assumptions rather than actual measurements. They also found the data provided to justify guaranteed savings was gathered predominantly by the Energy Savings Companies with little or no participation from the government agency. This vastly increased the risk of an ESPC project not achieving the projected savings and still paying for artificial rather than actual savings.

The GAO also found that internal energy audits of the Air Force and Army found more than one ESPC project was not achieving guaranteed cost savings, and that incorrect assumptions led to the inflation of energy baselines. Overall the GAO cites a lack of documentation, expertise, and complexity of ESPCs as chief problems in assessing the actual savings of ESPC projects.

In conclusion, the GAO believes that ESPC projects provide a valuable tool for Federal Agencies to achieve their energy policy goals and relatively quickly replace aging energy infrastructure that cannot be met through the normal appropriations process.

¹⁰ FY2005 DOD Annual Energy Management Report , p. 2,
http://www.acq.osd.mil/ie/irm/Energy/energymgmt_report/fy05/Final%20FY%202005%20Narrative.pdf
May 2006

However, the GAO believes there is significant uncertainty with actual achieved savings due to the complexity of these agreements, the lack of government expertise, limited auditing, and the reliance on estimates rather measurable results.

The GAO recommends Congress clarify the ESPC legislation with respect to the cost components that must be covered by savings and utilization of agency funding to make lump sum payments.¹¹

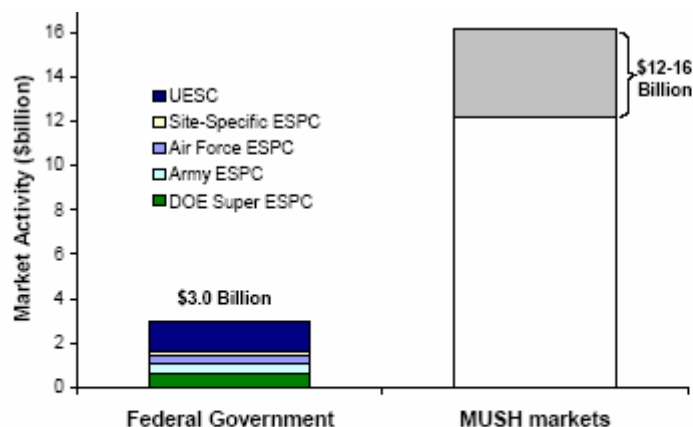
- The GAO recommends the following for all Federal agencies using ESPCs:
- Centrally Collect ESPC Best Practices, Cost Data, Verified Savings
- Obtain needed expertise across agencies and from industry to when embarking upon an ESPC project
- Require IG or other Agency Audit Offices audit all ESPC projects
- Expand competition, re-compete Super ESPCs regularly

L. ERNEST ORLANDO LAWRENCE BERKELEY NATIONAL LABORATORY GENERAL ACCOUNTABILITY ASSESSMENT OF ENERGY SERVICE COMPAMNY (ESCO)

The National Laboratory report reviews the performance of Energy Savings Companies under ESPC projects for not only Federal but also State and local governments, universities, and hospitals. The report reviewed more than 1600 projects, less than 10% of which are Federal.¹² As indicated by Figure 2 below, the vast majority of ESPC projects and investment occurred in Municipal, University, K-12 Schools, and Hospital markets (MUSH).

¹¹ GAO 05-340 Energy Savings Performance Contracts Offer Benefits. June 2005

¹² Ernest Orlando Lawrence Berkeley National Laboratory: Public and Institutional Markets for ESCO Services: Comparing Programs, Practices, and Performance. Berkeley, CA. Mar 2005. ix.



Sources: Branch & Skumanich (2003), FEMP (2002) and Strajnic and Nealon (2003) (federal ESPC market activity); FEMP UESC database (UESC estimate); NAESCO/LBNL database projection (MUSH market activity estimate)

Figure 2. Estimated Federal and MUSH Market Activity 1990-2003

The National Laboratory report compares ESPC projects with up-front congressionally appropriated projects. The report concludes that even with conservative discount rates of 5-7%, the inevitable delays of at least one or two years associated with congressional approval and the appropriations process, more than erodes the financial benefits of up front appropriations over privately financed ESPCs.

One of the key factors driving this conclusion is that through ESPC projects there is no decay in energy savings because payments are made only on guaranteed savings. Under traditionally financed projects, the Federal agency rather than the contractor is responsible for maintenance and upkeep of the energy improvements and there has been a historical decay in the energy savings amounting to 1-2% per year.¹³

The report concludes that despite differing assumptions, the Federal Government's Super ESPC projects from 1999-2004 have had a combined net benefit of \$138-\$256 Million and would have exceeded all but the most optimistic of scenarios under congressional appropriations.¹⁴

¹³ Ernest Orlando Lawrence Berkeley National Laboratory: Public and Institutional Markets for ESCO Services: Comparing Programs, Practices, and Performance. Berkeley, CA. Mar 2005. xii.

¹⁴ Ernest Orlando Lawrence Berkeley National Laboratory: Public and Institutional Markets for ESCO Services: Comparing Programs, Practices, and Performance. Berkeley, CA. Mar 2005. p. 81.

The report also analyzed trends in Federal ESPC projects. Federal ESPC projects have averaged a payback timeframe of 8.8 years. This timeframe is faster than the K-12 schools, the largest user of ESPC projects, at 14.7 years, but slower than Hospitals at 4.9 years, that have the smallest number of projects. The largest projects occur on University campuses with investments (\$2.43/Fort²) nearly 30% larger than the Federal Government investment (\$1.90/Fort²). Even though the vast majority of Federal projects entail improvements in lighting and Heating Ventilation, and Air Conditioning (HVAC), there has been an increase in renewable energies such as photovoltaic energy

The report concludes that to ensure ESPC projects remain a viable tool for the public sector, programs must accurately and openly track performance and progress. This will assist legislators in improving the program and also improve the planning process for new projects and encourage international policymakers to adopt similar programs.¹⁵

M. ESPC PROJECT EXAMPLES

1. Why ESPC Programs are Successful

There are many reasons why DoD installations need to find better uses of energy resources. This decrease in the use of energy resources not only benefits the DoD installation but also the taxpayers, and it may serve as a beacon to the States and industry to follow alternate energy practices. Executive Order (E.O.) 13123, *Greening the Government through Efficient Energy Management*, allows reimbursements for renewable energy sources toward the Federal Agency conservation goals. Because of the decrease in energy resources, the United States Government has looked at alternative sources of energy. These alternative sources of energy are known as renewable energy sources. These renewable energy sources include energy such as wind, solar and biomass which all are increasingly becoming viable options for American homes and buildings. One of these emerging renewable energy resources is the IEA Photovoltaic Power

¹⁵ Ernest Orlando Lawrence Berkeley National Laboratory: Public and Institutional Markets for ESCO Services: Comparing Programs, Practices, and Performance. Berkeley, CA. Mar 2005. p. 82.

Systems Program (PVPS). The objective of this program is to “enhance the international collaboration efforts which accelerate the development and deployment of photovoltaic solar energy as a significant and sustainable renewable energy option.”¹⁶

There have been many trials on the use of alternative resources throughout DoD installations along with private companies. The use of ESPC contracts has lowered the overall utility cost for most installations. An agency can contract with an energy service company for a period to develop energy efficiency in one or more agency facilities at no direct capital cost to the United States Treasury. The energy service company usually pays the upfront capital cost of the outfitting of the energy savings. Then the company takes a percentage of the actually savings of the energy use for the installation over a period not to exceed 25 years.

EPSC programs appear to be more successful when the energy savings company is monitored. Along with being monitored, energy saving companies need to have their baseline numbers verified to justify the cost and time of the payback of the upgraded infrastructure. An active energy savings company along with a dynamic agency is what leads to a successful ESPC program. Monitoring and verifying are the two key requirements that are necessary to make any ESPC program successful.

2. Successful Case of a Private Sector’s Experience with an ESPC Program

An example of a successful ESPC program in the private sector is the Central Washington University using Abacus Engineering System Company to perform some building upgrades to conform to new energy standards. The school is located in Ellensburg, Washington. The project consists of upgrades to twenty-five building’s distribution systems. The upgrades consisted of replacing steam lines and installing new steam and condensate meters, new chiller, cooling tower, electrical transformers, lighting, Heating, Ventilation, and Air Conditioning (HVAC) and control modifications.

¹⁶ IEA, “Trends in Photovoltaic Applications Survey report of selected IEA countries between 1992 and 2003,” 2004, Downloaded from www.oja-services.nl/iea-pvps/topics/i_dc.htm on April 21, 2005, p. 1.

Just by doing some of these modification to the building on campus, the project savings were 15,082,115 kWh for their annual Electrical Savings, 1,225,674 Therms for their Natural Gas Savings, 4,664,000 gallons for their water/sewer saving and a total cost avoidance of \$1,144,000.¹⁷ However, the project savings were not the only benefit of this ESPC contract at Central Washington University, there were also the environmental benefits. There is a reduction of CO₂ of 65,279,920 pounds per year along with a reduction in sulfur dioxide (SO₂), and nitrous oxide (NO). The total project cost was \$23,586,000 and the loan repayment plan is ten years at \$499,791 per year through 2009.¹⁸ There is no need for an inflation adjustment due to the baseline determining the savings, which would incorporate inflation, is the actual amount in which the ESCO would obtain.

3. Successful Cases of DoD's Experiences with ESPC Programs

An excellent example of DoD installations using an ESPC to lower cost of their energy usage is the Military District of Washington consisting of Fort Belvoir, Fort A.P. Hill, Fort Myer, Fort McNair and Fort Meade with Pepco Energy Services as the energy saving contractor. Pepco Energy Services provided a range of services to include equipment installation, measurement and verification, and energy engineering. The Pepco Energy Services solution included the following:

- Lighting retrofits and replacements.
- Cooling system retrofits and replacements.
- Air handling unit replacements and retrofitting.
- Central heating plant upgrades with new gas-fired boilers at two central steam plants.

¹⁷ Central Washington University, Energy Project Case Study, Department of General Administration, from <http://www.ga.wa.gov/EAS/epc/CaseStudy/CentralWU.doc> , Accessed 5 March 2006.

¹⁸Central Washington University, Energy Project Case Study, Department of General Administration, from <http://www.ga.wa.gov/EAS/epc/CaseStudy/CentralWU.doc> , Accessed 5 March 2006.

- Central cooling plant upgrades, including a new absorption chiller and chilled water distribution line.
- Water consumption and wastewater conservation measures in 160 buildings.

Pepco Energy Services upgraded 688 buildings to conserve energy. The contract is for Pepco Energy Services to maintain the equipment for eighteen years, which will save approximately \$200 million in energy cost and reduce CO₂ by 72,000 metric tons (MTC/yr) – the equivalent of removing 57,000 cars from the road each year.¹⁹

Another example of the use of an ESPC program is the Navy Region Southwest (NRSW) who recently became one of users of the largest Federal photovoltaic (PV) systems in the nation. This use of renewable energy technologies is a prime example of trying to cut cost to the taxpayers and DoD installations for their use of utility resources. The 750-kilowatt PV system is installed at Naval Base Coronado which makes this DoD installation one of the largest public-sector generators of clean renewable energy. This ESPC program is one of the largest renewable energy projects financed.

¹⁹ Pepco Energy Services, Success Stories: Military District Washington, Washington, D.C. from http://www.pepcoenergy.com/lgent/mil_dc.htm, Accessed 10 April 2006.



Figure 3. PV System at Coronado Base, CA

(From <http://www.cnrsw.navy.mil/Programs/PAO/News/Naval%20Base%20Coronado%20case%20study%2011.2.pdf>, March 2006)

As seen in the Figure 3, the carport PV system not only generates power for the base but also provides shade and protection for more than 400 vehicles stored in long-term parking for Navy personnel aboard deployed ships. This design is an excellent way for the Coronado Naval Base to reduce its utility cost by using the 924kwp photovoltaic system that was designed by Powerlight Solar Electric Systems along with providing a covered area for parked cars. This design is a brilliant way to utilize space that is already in use and make it into a functional car lot that also provides enough power. The PV system provides at least 3% of Coronado summer peak electric load and saves approximately \$228,000 operating cost starting in year one.²⁰

The environmental benefits of the PV system spare the environment from thousands of tons of harmful emissions, such as sulfur dioxide, nitrogen oxides, and carbon dioxide. Over the 25-year lifetime of the photovoltaic system, it is estimated that

²⁰ Commander Naval Region Southwest, Naval Base Coronado Case Study from <http://www.cnrsw.navy.mil/Programs/PAO/News/Naval%20Base%20Coronado%20case%20study%2011.2.pdf>, Accessed 1 March 2006.

the photovoltaic system will produce electricity that will reduce emissions of sulfur dioxide by 10,480 lbs, nitrogen oxides by 11,660lbs, and carbon dioxide by 7,430 tons. ²¹

The Coronado Base PV system contract has a straightforward payback of 5.8 years for the bundle of energy conservation measures for the base and a financed contract term for ten years for the entire bundling contract with Powerlight Solar Electrical System. The projected life cycle cost saving is \$111.7 million after reimbursing the contractor's initial capital investment of \$7.7 million.²² The Navy's capital input totaled \$2.2 million and third-party rebates totaling \$3.6 million.²³ A total of \$1.8 million of the cost was part of a special appropriation supporting the President's demand reduction program in the West.²⁴

4. Why Some ESPC Programs Fail

On the surface, Energy Savings Program Contracts are complicated, and the Government does not have the expertise necessary to administer these programs unless the government personnel are trained. Because of this complexity and the long term nature of contracts within the ESPC program, it is typically very difficult to determine if there is an actual savings to DoD when using an ESPC program. There is no national database on the actual use of ESPCs to provide any guidance or create a model to determine associated savings.

While there certainly are increases in efficiencies in the use of utility resources at DoD installations that have implemented an ESPC program some question whether it is

²¹Commander Naval Region Southwest, Naval Base Coronado Case Study from <http://www.cnrsw.navy.mil/Programs/PAO/News/Naval%20Base%20Coronado%20case%20study%2011.2.pdf>, Accessed 1 March 2006.

²²Federal Energy Management Program, U.S. Department of Energy, available from <http://www.eere.energy.gov/femp/>, Accessed 4 June 2006. 2006

²³Ibid.

²⁴Ibid.

worth the money and time for DoD to implement them. These questions come from some projects that had inadequate cost estimates or means to determine whether projected savings actually materialized.

In addition to the difficulty of determining whether projected savings have actually accrued, Third-party financing of ESPC programs can be more expensive than a suitable, complete and up-front appropriation to pay for the installation's energy resource upgrades (shown in Table 2). Table 2 shows six companies that were selected by the GAO on various ESPC projects. The cost of financing these projects was between 8 to 56 % more over the life of the contract than using a suitable, complete and up-front appropriation to pay for the cost, if such funding was available.

This is the most problematic area for ESPCs: by using finances from third-party, it could cost DoD and taxpayers more for the capital improvements to the installation on an annual basis on a contract with a long life such as twenty-five years instead of paying for the upgrades in one lump sum by using an appropriation. However, since Congress is loathe to provide funding, ESPC programs may be the only way to fund energy capital improvement projects.

Dollars in millions, present value			
ESPC project (term)	Cost of ECMs financed through timely, full, and up-front appropriations ^a	Cost of ECMs financed through ESPCs ^b	Percentage increase due to financing
Navy Region South West (10 years)	\$13.66	\$14.69	8
Patuxent River Naval Air Station (20 years)	\$4.33	\$5.77	33
Naval Submarine Base Bangor (9 years)	\$4.33	\$5.34	23
GSA Gulfport Federal Courthouse (17 years)	\$1.60	\$2.50	56
GSA North Carolina bundled sites (19 years)	\$1.39	\$1.93	39
GSA Atlanta bundled sites (20 years)	\$6.15	\$7.78	27

Source: GAO analysis of ESPC case study delivery order files.

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Table 1. Cost Analysis of Six ESPCs

²⁵ GAO Report GAO-05-340, Energy Savings, June 2005

Another cause of the failure of the ESPC program is that even when a contract is awarded, DoD lacks the expertise in the technical field or the contracting field to effectively negotiate and manage these energy savings contract. In order to manage these contracts DoD needs a base line of how the old equipment was functioning compared to the new installed energy saving equipment. Most contracting officers and local supporting engineers lack the ability to monitor savings during the contract's life span. Quite often, contracting officers have to rely on the expertise of some of the very same energy saving companies that the contracting officer has to negotiate with.

5. A Failed Case of an ESPC Program

It is very difficult to predict variables that will influence an ESPC program, but once a wrong prediction is made the agencies then have to assume some of the risk caused by this affect on the contract. The Army has conducted an audit of a 1999 project, indicating that the savings generated may not cover the initial capital cost. "The Army paid about \$96 million that might not cover the savings over the 18-year life of the project because savings that the Army agreed to were overestimated."²⁶ This audit determined that the baselines of labor cost were never verified to be correct. The audit also found that the baselines for the utility cost of water and electricity were inflated by the contractor as well. The technical expert was the contractor therefore none of the numbers that were provided were questioned.

The problem is that the baseline numbers were not verified prior to the negotiation of the contract. The poor documentation of the utility costs led to the awarding of an unfavorable Army contract. Trusting the contractor to come up with legitimate costs over the life of the contract was ill advised.

Energy savings baselines are what are utilized in determining whether the contractually guaranteed savings are achieved. It is necessary that these baseline numbers are heavily scrutinized by government experts or independent contractors with the requisite knowledge to verify that the numbers provided by the ESCO for the baseline

²⁶ GAO Report GAO-05-340, Energy Savings, June 2005

determination are accurate. As can be seen by this example the generation of a fair and reasonable energy baseline prior to award of the contract action is instrumental for a successful ESPC project.

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III. PHOTOVOLTAIC ENERGY AND FORT BLISS CASE BACKGROUND

A. PHOTOVOLTAIC ENERGY

The use of photovoltaic power systems is nothing new in the Department of Defense (DoD). In fact, DoD has installed these systems for many years on stand alone pedestrian and lighting systems at DoD installations. However, DoD is currently in the middle of a transformation on how they consider and plan for its energy usage. This new thinking within DoD is based on several factors that include declining budgets, executive mandates, and world politics. In the center of this transformation is the Army installation at Fort Bliss.

Photovoltaic energy is basically sunlight converted into electricity via photovoltaic or solar cells. These cells are semiconductor devices that have no moving parts. The basic component of these semiconductor devices is silicon. As the sunlight shines on the cells it absorbs a certain portion of the energy into the semiconductor. The energy that gets absorbed is utilized to excite the electrons. These free moving electrons move in a certain direction within the cell. This movement is the current and by placing metal on the ends of the cell, energy can be pulled for actual usage into a desired application. The current supplied can go directly into the application that is being used or into batteries for storage that can be used at a later date.

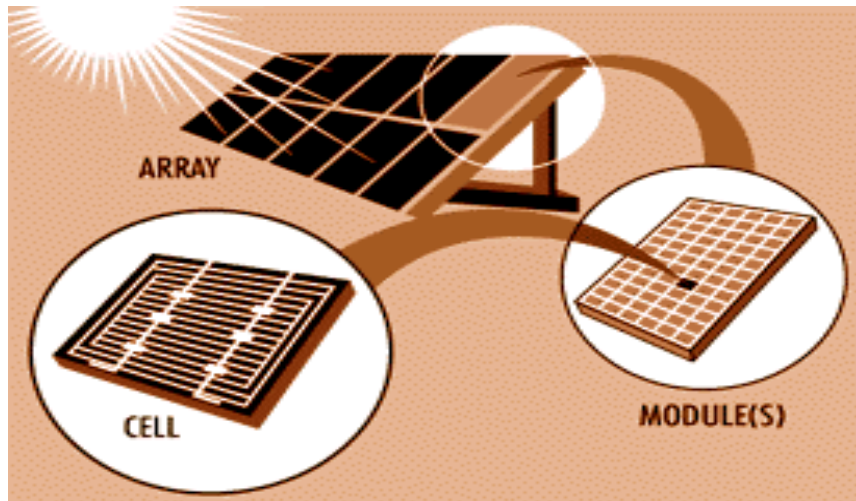
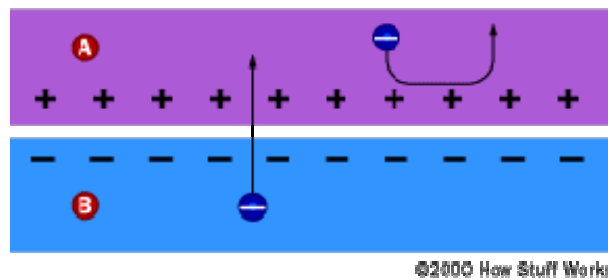


Figure 4. Photovoltaic Process

(From: www.newenergy.org/sesci/publications/pamphlets/photovoltaic.html, March 2006)



A n-type Silicon
B p-type Silicon

The effect of the electric field in a PV cell

Figure 5. Photovoltaic Cell Process

(From: www.newenergy.org/sesci/publications/pamphlets/photovoltaic.html, March 2006)

B. ENERGY CONVERSION EFFICIENCY OF CELLS

The efficiency of a photovoltaic system is the percentage of sunlight converted to usable energy. The efficiency of the conversion of energy in a photovoltaic system is driven by several factors to include: size of cells, temperature of area, and amount of cells that are connected together. As the size of solar cells increases, the efficiency decreases.

This is due to the fact that larger cells have a higher internal resistance. The inverse is true that a smaller solar cell has lower resistance. A photovoltaic system setup in a warmer climate is more efficient than one in the colder latitudes. In addition, the more cells you have connected will also lower your efficiency rating. The internal resistance of each cell will increase the total resistance lowering the overall efficiency.

The following two excerpts, C & D, were taken from the NPS Thesis by: Curtis Austin, Ralph Borja, and Jeffery Phillips “Operation Solar Eagle, A Study Examining Photovoltaic (PV) Solar Power as an Alternative for the Rebuilding of the Iraqi Electrical Power Generation Infrastructure.

C. NEW TECHNOLOGY

The Photovoltaic Power Converter (PVPC) was created to help the conversion process thereby essentially increasing the overall efficiency of the PV system [not the cell itself] by this amount. The PVPC is unique because it applies these technologies to an area of low power production, namely photovoltaic panels, which had previously received little attention from power conversion designers.

To address the variability of the amount of light energy striking the panel and the varying demands of the load, the PVPC incorporates two critical technologies – Maximum Power Point Tracking (MPPT) and Switch Mode Power Conversion (SMPC). Both of these technologies are proven and have been commercially available for years. Making use of these two technologies, Atira claims it can recover as much as 25 % of the available power that is currently wasted in conventional conversion techniques; thereby essentially increasing the overall efficiency of the PV system [not the cell itself] by this amount.

1. Maximum Power Point Tracking (MPPT)

The concept behind MPPT is that the circuit continuously monitors and optimizes the interface between the solar panel and the load/battery. The only way to continuously maximize the power output based on these two ever-changing inputs is for the output load to be constantly adjusted based on the level of exposure of the PV panel to the sun.

However, current MPPT circuits are designed only to optimize the panel input within a narrow range, as shown in Figure 15. In other words, when the light energy striking the surface of the panel is sufficient to generate a voltage that is within the battery's charging window, the MPPT circuit will maximize the amount of power that can be produced by that amount of light. If the light energy is insufficient to cross the threshold, no power is produced – it only maximizes what makes it into the window. The result is a PV panel with a specific nominal voltage. The panel cannot charge a load that exceeds its voltage window, such as an 18V battery. Below in Figure 16 is a schematic of a standard MPPT circuit.

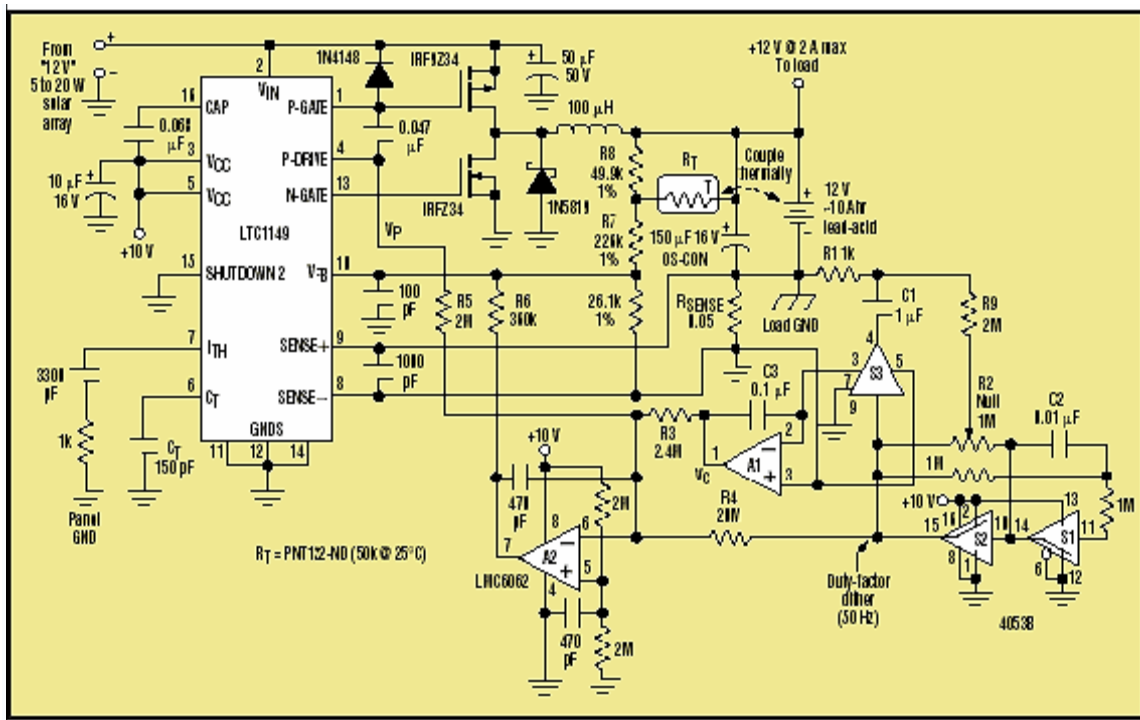


Figure 6. Schematic of Maximum Power Point Tracking Circuit
(From www.elecdesign.com/Articles/ArticleID/6262/6262.html, April 2005)

2. Switch Mode Power Conversion

Switch mode power conversion is the method by which the PVPC continuously adjusts the output load based on the amount of sunlight striking the surface of the panel. “In all applications of switch mode power conversion, input power to the converter is

equal to the output power generated by the converter, assuming no losses within the conversion process. Simply stated, 6 volts at 1 amp [output of the solar panel] is converted to 12 volts at 0.5 amps [by the PVPC].”⁷⁵ If the load on the PV system is a typical 12V battery, it has an approximate charging window between 11V and 14V. Voltages produced by the panel that are less than 11V or more than 14V are unusable for charging the battery and therefore wasted energy. However, if you changed the component characteristics of the power so that the 6V and 1A produced by the panel is converted into 12V and 0.5A, the threshold for battery charging is achieved. Also, if the SMPC can convert the 6V and 1A into 18V and .33A it can now charge an 18V battery, something a 12V panel could never do before.²⁷ By using the second concept of switch mode power conversion, the PVPC can both expand the range of batteries it can charge or applications it can power and extend the usable range of input solar energy. The PVPC changes the components of the power equation by switching the mode of the power, produced by the panel, from Direct Current (DC) to Alternating Current (AC). Once switched to AC, the energy now has another component characteristic – frequency, as measured in Hertz (Hz). By modulating the frequency to a higher level and then switching back to DC, the voltage is dramatically increased and the current is proportionally decreased to stay within the laws of $V \cdot A = W$. The result is a usable voltage level being produced by the system that can satisfy the load, whereas before voltage produced was too low to be usable. In the situation just discussed in which the panel is only producing unusable power, it can be argued that PVPC infinitely improves the system. We designed our tests to determine if a solar PV system with the PVPC integrated produces more power than a system without the technology.

3. Relevant Range of the PVPC

Currently, Atira is building the PVPC by hand from commercially available components. Each PVPC is built to optimize a particular panel’s power production. The three PC circuits we tested are known as the 0512, 0916, and the 1216 circuit boards. The

²⁷David A. Besser, “Photovoltaic Power Conversion Technology: Reserved Backup Power,”(Unpublished Document, Atira Technologies, Los Gatos, CA: May 12, 2004), p. 2.

first two numbers indicates the input Voltage of the panel the circuit was designed to optimize. While the last two numbers give the nominal upper Voltage limit the circuit can produce based upon that input voltage. For instance, the 0916 circuit is designed to optimize the power output of a 9V solar panel and can increase that Voltage up to about 16V. Therefore, as currently produced, one size does not fit all applications. When constructing the PVPC, designers must consider the particular power production characteristics of the solar panel as well as the power requiring characteristics of the load. The original PVPC circuit was the 1216, designed to work with the 12V Solengy glass panel. The 1216 was then subsequently modified into the 0916 to work with the 9v Uni-Solar LM-3 panel. The modification was done as a proof of concept to show that with the 0916 PVPC a 9V panel could indeed charge a 12V battery. However, the design was never matured to optimize at the 9V input level.

4. Physical Description

Figure 7, below, shows the physical appearance of the PVPC at the time of the April 2005 tests. Aтира currently builds the PVPC by hand, on printed circuit board with various capacitors, inductors, resistors, and input and output receptacles soldered on. It is 1.9375 inches (horizontally) by 1.625 inches (vertically) as shown below.

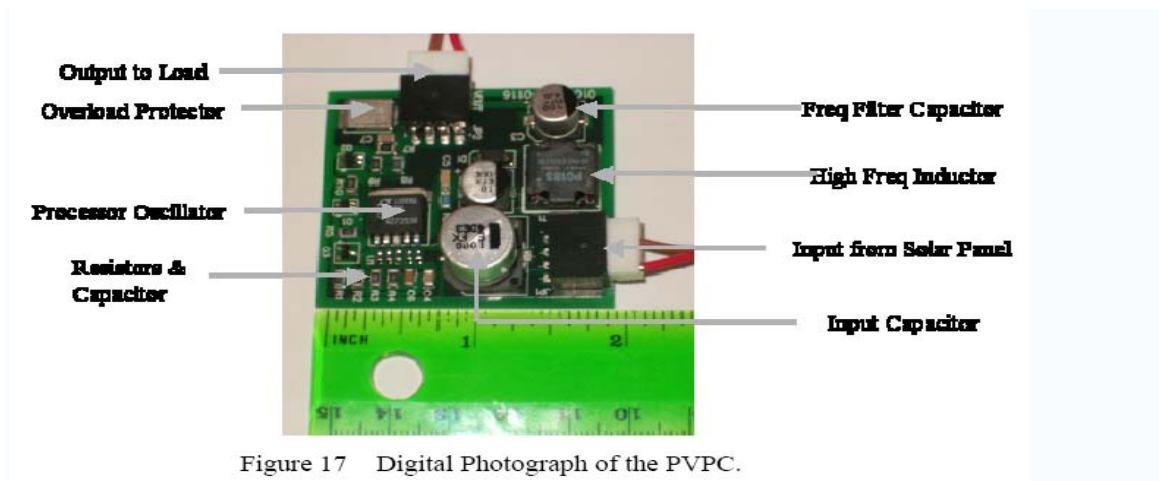


Figure 7. Digital Photograph of the PVPC

D. SUMMARY OF HOW IT PRODUCES POWER

Based on the preceding explanation of the two critical PVPC operating Characteristics, we provide the following concise description of how it produces usable power. Using switch mode power conversion, the PVPC continuously modifies the characteristics of the inherently variable power produced by the panel to provide the maximum amount of usable power, within a relevant range, to the attached load; it does this based on its changing power requirements, as determined by the maximum power point tracking circuit.

E. PV SYSTEMS

The basic two components for any PV project include solar panels and inverters. Solar panels were already previously discussed in this chapter. The amount of solar panels required for a project will depend on the electrical output desired. The standard energy source for most commercial and residential energy usage in the United States is Alternate Current (AC). The usage of AC is why inverters are critical because inverters transform the Direct Current (DC) produced through Photovoltaic generation into AC. Without an inverter, a PV system would not have commercial or residential applicability.

To determine the size of the PV system required, the following factors must be considered:

- Purpose: What is the desired system going to be used for? Is the system designed to replace or supplement existing power generation?
- Budget: How much capital can you invest into the system? Will traditional or private financing be used?
- Environmental Factors: Where is the system going to be built and how much land area is available?
- Energy Generation Requirements: What is the desired electrical output for the system?

These are just a few of the questions that need to be answered prior to developing any PV system.

The two main ways to erect a PV system include using either fixed or tracking array solar panels. In a tracking array a computer calculates the sun angles that will best maximize energy production. The tracking array then sends this information to the mounting station that moves the solar panel to achieve the maximum productivity. In a tracking array you can have solar panels that move on one axis or two axes of rotation to optimize sunlight.

The fixed solar panel array is a static mounting option that is best utilized on top of buildings or in areas with limited space. This mounting option puts an azimuth angle on the solar panel to best maximize its performance in the static mounting. These panels are best used when direct sunlight is achieved in a current location with little deviation throughout the year.

1. DoD and Photovoltaic Options

Congress has mandated that the DoD establish energy performance goals at every installation. These energy performance goals are to be utilized to help DoD recapitalize the generated savings to help procure assets in the future. The usage of ESPC's within DoD has increased every year. In particular, an increase in the usage of photovoltaic ESPC projects within DoD have been used to help realize utility savings.

Whenever DoD embarks on a photovoltaic project they can essentially choose from three different types of photovoltaic configurations. The first configuration is a photovoltaic system that is not tied to the electrical grid. These stand alone systems are an excellent choice to power parking garages, warning signs, and buoy markers. They are independent systems that require little maintenance and can run under any weather conditions.

The second system that DoD can utilize is a grid tied system. These systems work much in the same way as the stand alone variety. However, the grid tied systems are much larger systems generating significantly more output. This system does not store

any of the excess electricity created. Instead, the system can sell it back to the utility company. The utility company can accomplish this by employing a special inverter that changes the DC power into AC. This system is very economical because the cost to meet night time needs is avoided. Additionally, with access to the grid, the system does not have to be sized to meet peak loads.

The final system that DoD can utilize is a hybrid system. A hybrid system can be grid tied or non grid tied. The main difference in a hybrid system is the addition of a generator to help supply energy needs. This generator can be run by gas, wind, or steam.²⁸

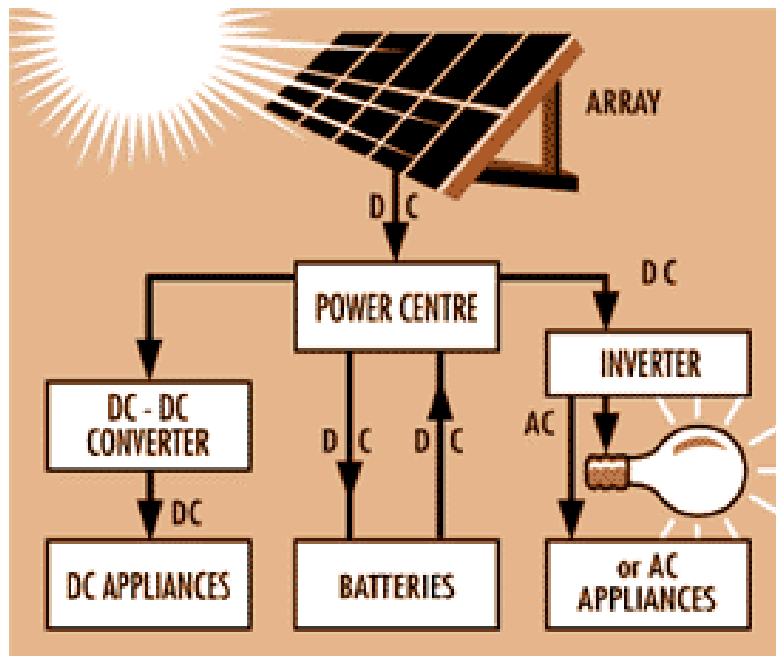


Figure 8. Photovoltaic to Customer
(from newenergy.org/sesci/publications/pamphlets/photovoltaic.html, April 2006)

F. EL PASO TEXAS CASE FACTS

The city of El Paso, Texas is the county seat of the El Paso district in Texas. The population of the El Paso area is over 600,000. The city is second only to San Diego in

²⁸ Advanced Energy Solutions Inc. Types of Photovoltaic Systems from <http://advancedenergyonline.com/resources/typesofpv.htm>, Accessed 6 March, 2006.

size of US-Mexico border cities. The sister city of El Paso is Ciudad Juarez which lies across the border in Mexico. The two cities are separated by the Rio Grande River.

The El Paso area is also home to Fort Bliss, a major Army installation. The base is the home of 15 major Army units. In addition, the base has 23 attached organizations on the base. The Army is a major supplier of jobs and commerce for the area. The recent base realignment and closure rounds in Congress attested to the importance of Fort Bliss to the Army's training and readiness. The base is scheduled to receive 11,500 additional troops due to the 2005 Base Realignment and Closure (BRAC) commission recommendations. In addition, the Army has planed to move units from overseas bases to Fort Bliss. In total it is expected that the Fort Bliss area will grow by 60,000 soldiers and families over the next several years.²⁹

The local economy of El Paso has been affected by competition for low wage labor overseas. This competition led to the closure of several key employers within the area further dampening the local economy. The economy of El Paso is very sensitive to the changes in the Mexican economy and cross border trade within the region. The added troops from Fort Bliss are estimated to bring in an additional \$547 million to the El Paso Economy. The city has a population that is relatively young. The median income of a household in the city is \$32,124. The per capita income for the city is \$14,388.

The city of El Paso and Fort Bliss have a total area of 250.5 miles. It is located in a very arid climate. The region is on of extreme with temperature in January reaching 56 degrees to a low of 29 degrees. In the summer the average temperature is 97 degrees with a low of 68 degrees. The sun shines 302 days out of the year with 83 % daylight hours. That is why El Paso is nicknamed The Sun City. The average rainfall for the area is only 8.74 inches a year. The rainy season for the area starts in July and ends in September.³⁰

²⁹ Congressmen Reyes' Weekly Column:"BRAC: New Troops to Revitalize Fort Bliss and El Paso", 2005.

³⁰ Wikipedia, The Free Encyclopedia "El Paso, Texas," from http://en.wikipedia.org/wiki/El_Paso%2C_TX Accessed 15 March 2006

G. PRICING ELECTRICITY

The previous section discussed how solar power was derived as well as the new technology that is going to make solar power more viable. This section will look at how utilities price electricity for their residential and commercial customers. The residential & commercial customers of Fort Bliss get their electricity from the El Paso Electric Company. This is the lone utility provider in the area. The service map of El Paso Electric is attached below.

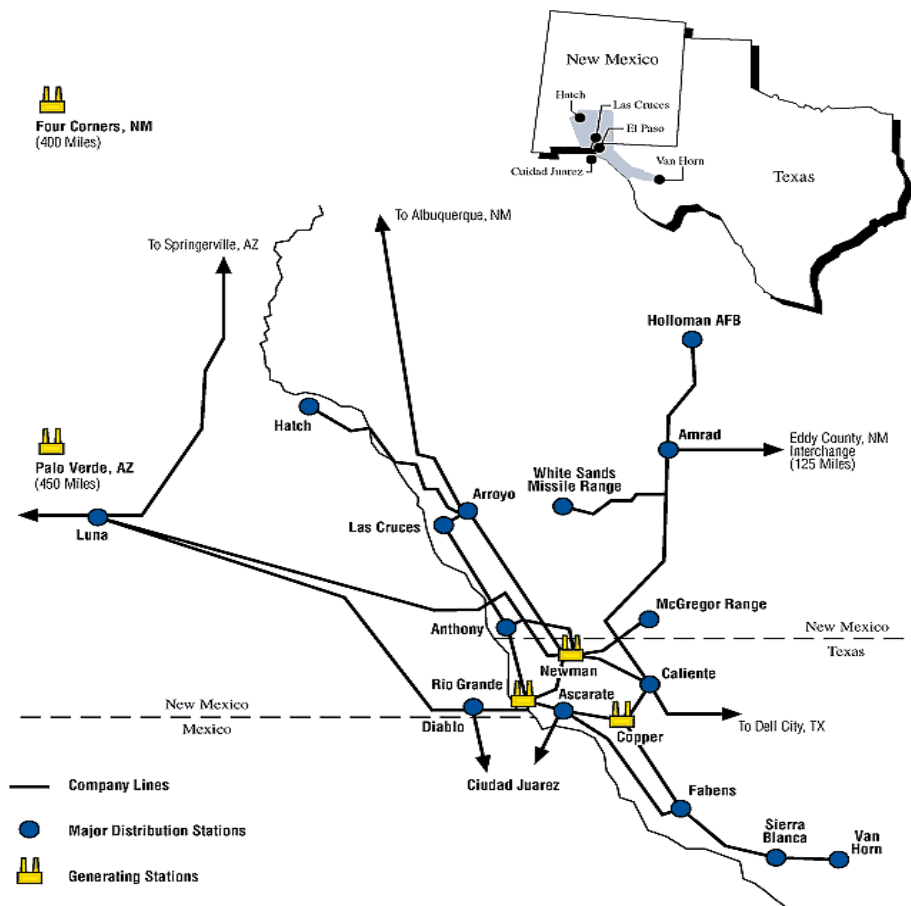


Figure 9. Service map of El Paso Electric
(From www.epelectric.com/internetsite/about.nsf/by+subject/service+territory+map, April 2006)

1. Residential Usage

The typical residential household is only billed for their current energy usage. However, the rate that gets used depends on seasonal variances. The current summer based energy rate for residential units at Fort Bliss is .08027 a kilowatt hour. The current non peak rate or non summer rate is .07527 a kilowatt hour. In addition, residential customers get a monthly service charge of \$4.50 per month. This small fee covers the distribution costs of moving the electricity to the homes.

The family housing at Fort Bliss is comprised of 3,052 units. These units are made up of two bedroom duplexes and four bedroom family style houses. In addition, the BOQ and BEQ have 92 units. This means that the Fort Bliss area has a total of 3,144 units of residential space. The average household uses 8,900 kilowatt hours of electricity each year.³¹ The Fort Bliss residential usage is concluded to be around 28 megawatts of energy yearly.

2. Commercial Usage

The commercial industry gets billed differently than the residential sector. In the commercial sector the utility companies enter into contracts for the supply of electricity. These contracts specify the minimum contract capacity to be supplied to the entity. If their actual usage is lower than the minimum required they pay the minimum electrical quantity specified in the contract. However in most cases the companies use more than the minimum and pay accordingly. To set the peak demand rate for commercial companies, the energy service provider looks at the peak KW demand between preset peak hours. The energy provider then sets a rate based on this peak usage. In addition, the companies get a monthly rate charge for delivery of their electrical needs.

The military reservation rate for Fort Bliss, Texas states that the minimum capacity to be billed monthly is 10,000 kilowatt hours. In addition, the demand charge on all required electricity is \$23.25 per kilowatt. The energy charge per kilowatt hour for all

³¹ "Power Consumption of a Home," The Physics Fact Book from <http://hypertextbook.com/facts/2003/BoiLu.shtml>, Accessed 15 March 2006.

kilowatts demanded is .00853. The Fort Bliss army base will be charged monthly either the minimum kilowatt hours or actual usage if it is higher.³²

The rates that are supplied to both residential and commercial customers are based off of historical peak load demand, surpluses in the market and environmental conditions of the area. The only thing that customers of the utility companies can control is the demand placed on the electrical grid. If the Fort Bliss installation can put a PV system in place it will allow the installation to shave the peak demand load requirements which would allow for a negotiation of cheaper utility rates. The figure below shows the price of electricity sold to utilities through 1999.

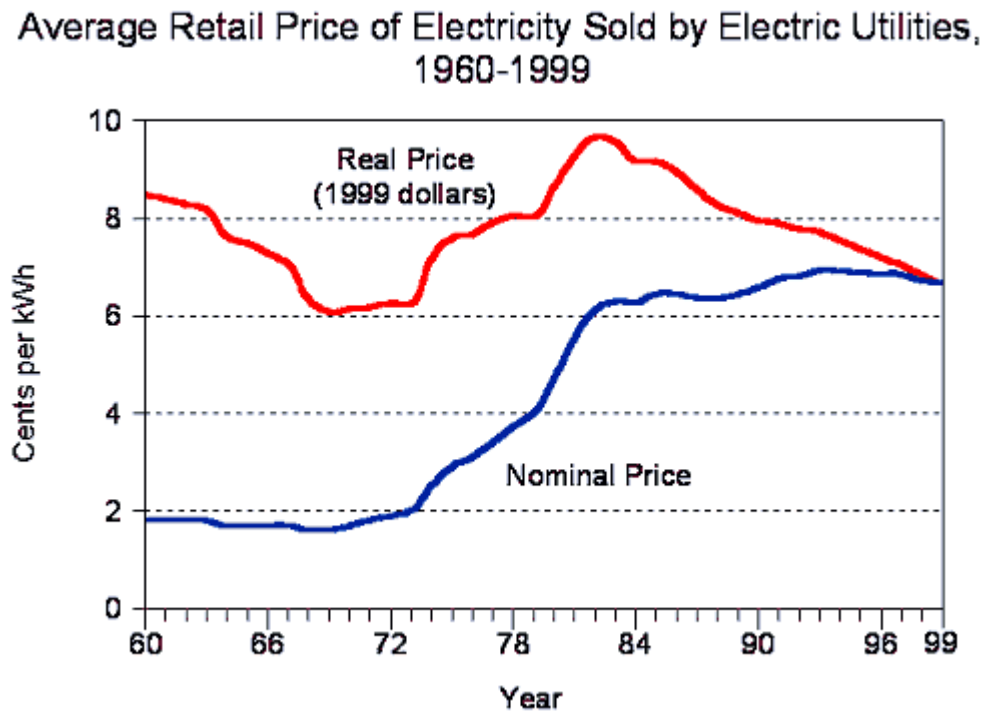


Figure 10. Average Retail Price of Electricity 1960-1999
(From www.eia.doe.gov/cneaf/electricity/page/fact_sheets/retailprice.html, April 2006)

³² El Paso Electric Schedule NO 31 Military Reservation Service Rate.

H. PHOTOVOLTAIC POWER WITHIN FORT BLISS

The area that Fort Bliss is located on is a prime area for any photovoltaic project. The Southwest area of the United States has many areas with very little rainfall and many sun hours per day. The chart below shows the solar isolation for the Fort Bliss/El Paso Texas area. By comparison you can see the some of the other states and why El Paso is ideal for this type of energy. The figures in the chart are based on kilowatt-hour per square meter per day.

Solar Isolation Table				
State	City	High	Low	Avg
TX	Brownsville	5.49	4.42	4.92
TX	El Paso	7.42	5.87	6.72
TX	Fort Worth	6.00	4.80	5.43
MO	St. Louis	4.87	3.24	4.38
AK	Fairbanks	5.87	2.12	3.99
MA	Natick	4.62	3.09	4.10
WI	Madison	4.85	3.28	4.29

Table 2. Solar Isolation

(From www.advancedenergyonline.com/Resources/solarisolation.htm, April 2006)

IV. COST BENEFIT ANALYSIS OF PHOTOVOLTAIC ENERGY ON FORT BLISS

Fort Bliss is an ideal location for establishing a pilot project for the entire DoD. Fort Bliss has selected a location for a pilot project within the main cantonment area. The size of the area for their solar panel array is roughly eight acres of land. This land area translates to approximately 8000 solar panels for the array. The area is not currently used in any capacity and has no obstructions. The solar panels need only be elevated high enough to avoid the potential runoff from seasonal rain. This building constraint is due to the fact that the array will be constructed in a runoff easement.

By utilizing the plot of land to accommodate a solar power array in the Fort Bliss area the following benefits are realized:

- Reduced generation, transmission, and distribution charges.
- Increased the long term value of the base and land.
- Protection from potential costly increases in electrical prices over the next three years.
- Reduced vulnerabilities to grid tied systems.
- Improved controls.
- Load Shed capabilities.
- Reduced peak load times and consumption.

A. FINANCING

A Standard Financing Offer (SFO) will be needed from any contractor willing to take on this project. The SFO is used by the financier to give the contracting officer a complete view of the financing package. The information stated must include, but is not limited to, the following:

- Third party capitalized construction- period interest costs.

- Establishment of escrow and trust accounts for construction draws, administration expenses.
- Timing of project financing closing date and certain initiation of repayments.
- Timing of Government payments.
- All Fees for Professional services.
- Capitalized construction period interest.
- Hedge costs.
- Pre performance period payments.

In addition, all financing offers shall be based on the applicable rate index. The maturity of this index shall be equal to the performance period. An example of this would be an ESPC with a 17 year performance period. The index would be at a maturity of 17 years.³³

The average project financing rate for implemented Federal ESPCs is 8.07%.³⁴ However, this rate could be lower with a very large ESPC certified contractor. For example, the pool of large ESPC certified vendors is limited to four on the DOE western region super ESPC contract certified vendors website. These large vendors can offer better rates and obtain lower financing due to their large capital holdings. If you contract with a smaller company that is not ESPC certified that company must be certified before moving ahead with the project. The smaller company may have a higher interest rate because it may be assuming more risk during the project than the larger companies.

³³ US Department of Energy “A Practical Guide to Saving & Payments on Super ESPC Contracts” Jan 2003.

³⁴ Financing or Appropriations: Which Is Best-Value for Implementing Federal Energy Conservation projects? Patrick J. Hughes John Shonder Oak Ridge National Laboratory.

B. MEASUREMENT AND VERIFICATION

Any ESPC contract that Fort Bliss enters into has to take into account measurement and verification (M&V). Measurement and verification provides all parties standards from which to validate and compute the verification of energy savings. These guidelines seemed necessary to alleviate wasted man-hours negotiating verification requirements in past contracts.

The Federal Energy Management Program has four options for any ESPC contractor to choose from. The least costly verification measure is Option A. This option is designed for projects where the potential for savings must be measured, but where the actual savings can be computed by engineering calculations and short-term data.

The second verification method is Option B. This option has all the associated verification of Option A; however, it has more end metering. The calculations of Option B are from physical assessments of equipment change outs to check equipment specifications. The potential for savings comes from physical inspections, observations and metering to validate the baseline measures.

The third verification method is Option C. This option should only be used with complex systems involving whole-facilities. This option also works best when baseline and post installation data are available. The collection of this historical data and continuous measuring is warranted to ensure the equipment is within standards. The energy savings measured from Option C are extrapolated by taking the data and creating statistical models for the whole-facilities energy consumption.

The final verification method is Option D. This method of verification is the most expensive due to its whole facility concept. In Option D you usually have multiple ECMs installed. The complexity of these projects makes the development of sophisticated computer models a must for any verification in Option D. ³⁵

³⁵ US Department of Energy "M&V Guidelines: Measurement & Verification for Federal Energy Projects" September 2000.

C. PROJECT SPECIFICS

This recommended project is very similar to one that was completed in 2003 at the United States Marine Corps base at Twenty-Nine Palms. The following similarities between Twenty Nine Palms and Fort Bliss provide a basis for comparison.

The area of land at Fort Bliss for the solar panels will allow for approximately 8000 panels on site. The photovoltaic modules that are used for the basis of estimate are Sharp-165W modules. These panels are very reliable and have been installed at several DOD installations in past photovoltaic projects.³⁶ The inverter used for the cost estimate is the Trace/Xantrex three phase inverter. This inverter is designed for cost effectiveness, high performance, easy installation and reliability.³⁷ To get better efficiency out of the system a tracking system is preferred over a fixed tilt system. The tracking system utilized for the estimate is the EnergyMax Tracking system. This system follows the sun from east to west maximizing sun exposure and the performance of the panels. In addition, this tracking system can generate 35% more output than a fixed tilt system by following the sun's path.³⁸

Once a solar power array is in place it requires very little direct support costs. The panels themselves have no moving parts and rarely malfunction. In the course of three years the Twenty-Nine Palms project has replaced only three panels. The inverters used on solar arrays are also very stable units. In the past three years the Twenty-Nine Palms project has had to replace one inverter due to rodents chewing the wires. With this analysis one can conclude that direct support costs for an ESPC project valued at over six million dollars would be negligible in the short term. However, there are no data concerning long term reliability of these systems.

³⁶ BP Solar international from
<http://www.bp.com/modularhome.do?categoryId=4260&contentId=7004852>, Accessed 15 March 2006.

³⁷Solar Panel Quotations from the Alternative Energy Store from
<http://shop.altenenergystore.com/itemdesc.asp>, Accessed 5 April 2006.

³⁸"Energy Max Solar Electric Ground Systems," BP Solar international from
<http://www.bp.com/modularhome.do?categoryId=4260&contentId=7004852> Accessed 15 March 2006.

On average the design costs associated with ESPC contracts are approximately 30% of the total contract amount. This 30% is based on the average of 71 ESPC that FEMP has worked on during the past five years in the western region. The design costs cover the entire grid tied planning, project layout on site and other associated planning costs. In addition to the design costs of a system Fort Bliss must also look at having site preparation and installation costs included into any ESPC contracts. The site preparation would include but is not limited to the leveling of the land with equipment, running electrical grid connections, and building foundations for the system.

The Army installation at Fort Bliss has an abundance of labor to draw upon for site preparation. Our analysis of the costs of the system takes into account the availability of this pool of labor. By utilizing its own labor, force Fort Bliss can take site preparation costs out of any contract that it enters into for an ESPC.

The estimated costs for the solar array system on Fort Bliss are detailed below:

Components:	Qty	Unit	Ext Cost
Panels Sharp 165 W	8000 Ea	\$ 450.00	\$ 3,600,000.00
Trace Technology three phase 20kw inverter	3 Ea	\$ 23,348.68	\$ 70,046.04
Energy Max Tracking Ground System	1 Ea		\$ 2,510,000.00
(Costs Obtained from Twenty Nine Palms ESPC)			
Installation			\$ 2,400,000.00
(Approximate Based on Twenty Nine Palms ESPC)			
	Subtotal		\$ 8,580,046.04
Design (30% Avg for Federal ESPC Projects)			\$ 2,574,013.81
Total Capital Outlay			\$ 11,154,059.85

Table 3. Estimated Cost for Solar Array System

The price of this system can be decreased further if Fort Bliss can allocate labor resources to assist with the installation. However, it will be up to Fort Bliss and the contractors to specify in the contract exactly what Fort Bliss will have responsibility for during the installation.

D. SOLAR ARRAY

To analyze the output of a solar array, it is first important to understand solar efficiency. Solar efficiency is a function of the full power output of the sun. Measured at the equator at noon on a clear day on the March or September equinox, one square meter of the earth's surface receives 1000w of power.³⁹ The Sharp 165 Solar panel used in this analysis is approximately 1.32 square meters, and therefore has a solar efficiency of 125W/m² or 12.5%.

The output of the solar array can be estimated by looking at the environmental conditions of the area and the proposed PV system specifics. With this data, a close approximation may be made on the total energy the solar array will produce.

The determination of what a typical solar array will produce without the new solar PVPC unit must first be evaluated. The estimated annual output of the solar array on Fort Bliss utilizing eight acres of land and 8,000 solar modules efficiency at 100% is 4,336 Mega Watt Hours (MWH). Although the panels are rated at 165W they still exhibit a loss of power due several factors to include size of the cell, temperature, and internal resistance. The following table illustrates potential output for a standard array at 20% reduction in power rating efficiency. Therefore each panel will produce 132W of the 165W panel rating.

Regular Solar Array				
	Solar Hrs	Daily KWH	Monthly KWH	Savings
Jan	7.06	7455	231116.16	\$ 46,223.23
Feb	7.96	8406	235361.28	\$ 47,072.26
Mar	9.1	9610	297897.60	\$ 59,579.52
Apr	10.18	10750	322502.40	\$ 64,500.48
May	10.91	11521	357149.76	\$ 71,429.95

³⁹ Full Sun Definition, Department of Energy Solar Energy Technologies Program, Solar Glossary http://www1.eere.energy.gov/solar/solar_glossary.html, June 2006.

Jun	11.15	11774	353232.00	\$	70,646.40
Jul	9.86	10412	322776.96	\$	64,555.39
Aug	9.12	9631	288921.60	\$	57,784.32
Sep	9.18	9694	300516.48	\$	60,103.30
Oct	8.73	9219	276566.40	\$	55,313.28
Nov	7.43	7846	243228.48	\$	48,645.70
Dec	7.14	7540	226195.20	\$	45,239.04
Average	8.99	9488	287955	\$	57,591.07
Total Annual Savings			3455464.32	\$	691,092.86

Table 4. Solar Production of Standard Array (20% loss of efficiency)

In reviewing the past six months of utility cost data at Fort Bliss the average electric utility cost is \$.20 KWH.⁴⁰ At the current rate without the new technology of the PVPC the annual saving for the Fort Bliss installation based strictly on utility usage would be \$691,093. In addition, the PV array would reduce the peak demand by the maximum production output of the array at 1056 KW or \$24,552 monthly in peak demand savings. This output of 1056 KW is due to the 1.32 MW solar arrays operating at an efficiency of 80%. This equates to annual energy peak savings of \$985,717. The monthly cash flow in savings for this project would be \$82,143.

Annual KWH from Standard Array	3,455,464 KWH	\$0.2 /KWH	\$691,093
Avg Annual Peak Demand Savings	1056 KW * 12 Mos	\$23.25/KWH Demand	\$294,624
Total Savings			\$985,717

Table 5. Savings from Standard Solar Array

The solar array estimated above has not incorporated the new PVPC technology. This Solar PVPC unit is currently being tested by Arizona Power Supply, the utility provider for the State of Arizona, and is expected to decrease the inverter and wiring losses brought about through the conversion process. The Arizona Power test plan is a

⁴⁰ Army Energy and Water Reporting System www.army-enrgy.hqda.pentagon.mil Accessed 30 May 2006.

two phase plan. The first phase of the test was the functionality of the PVPC. In this phase the component charges batteries per manufacturer's requirements. In addition, this test will place a steady load on the system and will be hooked up to a utility grade service meter. The second phase of the testing is the PVPC efficiency test. This test involves the evaluation of the component during different light levels. In addition a comparative test will be accomplished against the Outback MPPT charge controller. This test will be done over a one month timeframe. The Arizona Power ISG test plan is contained in Appendix C.

This technology is still being independently validated under phase II of the project. Therefore, we can only use the initial conclusion that this technology can help generate an increased yield of up to 22% more than the industry standard today.⁴¹ The calculations for the solar array with the Solar PVPC unit installed are depicted below at 161W of the 165W rated panel or 98.5% of the panel power rating. The energy max tracking system also boosts the total solar radiation hours by an average of one hour per day.

	ISG Solar Array			
	Solar Hrs	Daily KWH	Monthly KWH	Savings
Jan	8.06	10480	324867.97	\$ 64,973.59
Feb	8.96	11650	326194.18	\$ 65,238.84
Mar	10.1	13132	407092.62	\$ 81,418.52
Apr	11.18	14536	436087.08	\$ 87,217.42
May	11.91	15485	480046.84	\$ 96,009.37
Jun	12.15	15797	473922.90	\$ 94,784.58
Jul	10.86	14120	437725.33	\$ 87,545.07
Aug	10.12	13158	394740.72	\$ 78,948.14
Sep	10.18	13236	410317.12	\$ 82,063.42
Oct	9.73	12651	379528.38	\$ 75,905.68
Nov	8.43	10961	339781.27	\$ 67,956.25
Dec	8.14	10584	317508.84	\$ 63,501.77
Average	9.99	12982	393984	\$ 78,796.89
Total Annual Usage Savings			4727813.24	\$ 945,562.65

Table 6. Solar Production of ISG Solar PVPC (98.5% Efficiency)

⁴¹ Phone Conversation with PVPC inventor Stephan Mehan, 14 May 2006.

As reflected above, the new PVPC will allow for the same solar array to produce an additional 1,272,348 Kilowatt Hours of usable energy annually. That is an increase of approximately of 37% from the standard array. In addition the annual energy savings on actual usage would be \$945,562. In addition Peak Demand would be reduced by 1,300 KW or peak demand savings of \$30,230/month. This translates into an annual savings of \$1,308,318 and average monthly savings of \$109,026.

Annual KWH from ISG Array	4,727,813 KWH	\$0.2 /KWH	\$945,562
Avg Annual Peak Demand Savings	1300 KW * 12 Mos	\$23.25/KWH Demand	\$362,756
		Total Savings	\$ 1,308,318

Table 7. Savings from ISG Solar Array

E. ESTIMATED SAVINGS

The installation of a PV array at Fort Bliss has the potential to save the base an average \$1.3M annually. This array will reduce the monthly peak demand by 1,300 Kilowatts. By analyzing current El Paso electric commercial utility contracts the corresponding demand charge may decrease by greater than 10 %. Peak Demand unit charges are not straight line but rise exponentially with Peak Demand. Fort Bliss may be able to renegotiate a lower peak demand unit charge by reducing its peak demand and thereby generating increased peak demand savings.

Per the following simple payback schedule, the project will pay for itself in a little over eight years.

$$^{42} \text{Payback Period (in years)} = \frac{\text{Initial Investment}}{\text{Annual Savings (Cash Flow)}}$$

Payback Period = \$11,154,059/ \$1,308,318

Initial Investment = \$11,154,059

Annual Savings = \$1,308,318

However, private financing and a reasonable contractor profit will greatly extend the true payback period.

F. PAYMENT SCHEDULE

This analysis is based on the average Federal ESPC project financing rate of 8.07%.⁴³ At this rate with a maximum payback period of 25 years the solar array would have to generate monthly savings of around \$86,606. This payment is derived from the following data:

Rate: 8.07%/12

Periods: 300 (25 yrs * 12 months/yr)

PV: \$11,154,059

FV: \$0

PMT= \$86,606

The payment amount and payback period is very sensitive to the financing rate. The following table identifies the difference in projected payments for a range of

⁴²U.S. Department of Energy, Office of Science from <http://www.er.doe.gov/sc-80/sc-82/wrkshp/payback.doc>, Accessed 15 March 2006.

⁴³ DOE FEMP Energy Efficiency Workshop and Exposition www.energy2002.ee.doe.gov Accessed 10 May 2006.

financing rates and payback periods. Included is the current U.S. Treasury rate for a 20-year maturity that most closely resembles the timing of the payback period.

Payment Fluctuation by Rate and Payback Period				
	PV	\$11,154,059	\$11,154,059	\$11,154,059
	Payback yrs	25	20	17
	Financing Rate			
AvgFedESPC	8.07%	\$86,606.71	\$93,783.53	\$100,657.87
	7%	\$78,834.57	\$86,477.30	\$93,656.24
	6%	\$71,865.76	\$79,911.14	\$87,347.52
US 30yr TBill	5.30%	\$67,169.88	\$75,472.88	\$83,071.26

Table 8. Payment Fluctuation Rate

Table 8 indicates that an exclusive Photovoltaic ESPC project at Fort Bliss will be to the benefit of the U.S. government and industry. It is apparent from these calculations that an ESPC project can generate enough annual savings to overcome the large capital investment. The current estimate of annual savings of \$1.3 M or \$109,026 monthly exceeds the required debt service payments of \$86,606. In fact, the project can achieve a payback period of 17 years at the average Federal ESPC financing rate of 8.07% and debt service payments of \$100,657.87.

The next step in considering this project is negotiating the portion of guaranteed savings paid to the contractor. These energy savings payments will allow a contractor to service the debt on the capital investment and retain any remaining savings as profit. An ESCO contractor bears substantial risk in embarking upon an ESPC project and will expect a healthy profit level to compensate for this risk. The GAO report and Lawrence Berkeley Laboratory study on ESPC projects has estimated the average payment to an ESCO as 98% of the guaranteed savings.⁴⁴ In the Fort Bliss proposed ESPC, we can determine a contractor profit level based on this 98% payment.

⁴⁴ GAO 05-340 Energy Savings Performance Contracts Offer Benefits. June 2005 p. 22.

Annual Guaranteed Savings	\$	1,308,318
98% Guaranteed Savings	\$	1,282,152
Annual Debt Service	\$	1,207,894
Annual Profit	\$	74,258
Total Profit	\$	1,856,440
Capital Investment	\$	11,054,159
Profit as a % of Cap Investment		16.8%

Table 9. ESCO Profit Calculation

From the analysis, we can see the ESCO profit for a 98% guaranteed savings payment over the life of a 17 year ESPC project to be 16.8%. While some may argue this level of profit is high, particularly if this project were traditional up front financing through the appropriations process. One must consider the considerable risk the ESCO assumes. If the savings do not occur the ESCO does not receive the payments.

Fort Bliss can further negotiate down guaranteed savings payments and thus contractor profit by closely scrutinizing the initial capital investment. Both design and installation costs are prime candidates for savings. Design savings may be achieved by utilizing the Twenty Nine Palms solar array design as a baseline. In addition, Fort Bliss has a large resource of human capital in the soldiers stationed at the installation that may help defray installation costs.

In order to compare an ESPC project with traditional full up front funding a calculation of the net present value of the guaranteed savings payments versus the initial capital investment must be conducted. In this scenario an assumption that the contractor is paid 98% of the guaranteed energy savings computed above for the duration of the 17 year ESPC was made. With these assumptions a comparison can be made between traditional up front funding and the ESPC as detailed below. A discount rate of 2.53%, the average CPI for the last 10 years was used for this analysis.⁴⁵

⁴⁵ Bureau of Labor Statistics. Historical CPI rates for 1995-2005. www.bls.gov, Accessed 01 June 2006.

Traditional Up Front Funding

Initial Capital Outlay Yr 0 w/ 10% profit;	\$12,269,465
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ESPC Project

Guaranteed Savings Annual Cash Outflows	\$1,308,318
Guaranteed Savings Annual Cash Inflow	(\$26,166)
Number of Payments	17 Years
Discount Rate	2.53%
NPV (Guaranteed Savings):	\$17,537,935

This analysis identifies that full up front funding would save approximately \$5.3M more than the PV ESPC project. However, these savings do not include maintenance that would be the responsibility of the government, continued probable escalation of utility rates, and probable annual efficiency losses by operation of the ECM by government personnel.⁴⁶ This analysis supports recent GAO findings that ESPC projects are almost always more expensive than full upfront funding.⁴⁷

In addition, the solar array has the potential to continue to produce significant savings well beyond the 17 year payback period. Although most solar panels have limited warranties lasting 25 years, in dry arid environments such as the El Paso and the Southwestern U.S. these panels can last 40 or more years.⁴⁸ This additional 20 plus years of potential savings will solely be the U.S. Army's as title for the array will transfer to the government at the end of the payback period.

By comparing the different solar systems it shows where the new PVPC being developed by ISG can help create greater efficiencies for a PV system. In addition, we can see that the technology is viable and can generate real savings for the installation.

⁴⁶Ernest Orlando Lawrence Berkeley National Laboratory: Public and Institutional Markets for ESCO Services: Comparing Programs, Practices, and Performance. Berkeley, CA. Mar 2005. p. 60.

⁴⁷ GAO 05-340 Energy Savings Performance Contracts Offer Benefits. June 2005.

⁴⁸ Sierra Pacific Power; *Solar Generations*; retrieved from <http://www.solargenerations.com>, Accessed 02 June 2006.

The PVPC verification and validation will be completed by the end of June. The final report validating the results from APS will be completed in the middle of July. These results may indicate that the PVPC yields even greater results than expected. These greater results may further improve the project's savings and shorten the payback period.

The savings calculations above are based upon a solar array of 1.32 Megawatts of power generation. Fort Bliss currently uses approximately 20 Megawatts of electricity per year.⁴⁹ An expansion of the solar energy generation capability may produce additional savings as power generation requirements increase with the growth of Fort Bliss through the BRAC process. Fort Bliss energy costs rose significantly in June 2005, from an average of \$.08/KWH to \$.20/KWH.⁵⁰ As energy costs continue to rise, even larger Photovoltaic Arrays than the one proposed here will become the focus of more ESPC projects across the Southwestern U.S. As Solar Energy technology improves, and with the commitment of additional land resources, it has the real potential of taking over the entire electricity generation at Fort Bliss.

This chapter provided a cost benefit analysis of implementing an exclusive Photovoltaic Solar Array ESPC project at Fort Bliss. The analysis reviewed current utility costs and compared the potential savings generated from a traditional solar array and new PVPC solar array technology currently undergoing testing. The analysis has shown that there are potentially significant savings generated from either traditional or new technology in solar arrays. Given the initial conclusions of the testing of the ISG array, the potential savings is more than sufficient to support the large private Capital Investment required for an exclusive PV ESPC project at Fort Bliss. The following chapter will present conclusions, answers to research questions, and recommendations.

⁴⁹ Army Energy and Water Reporting System www.army-enrgy.hqda.pentagon.mil, Accessed 30 May 2006.

⁵⁰ Ibid.

V. CONCLUSIONS AND RECOMMENDATIONS

The following chapter contains conclusions, answers to research questions and recommendations. Additionally, this chapter provides areas of future research that are applicable for DoD ESPC projects.

A. CONCLUSIONS

This project concludes that Photovoltaic Systems offer a feasible solution to significantly reduce the dependence on the existing energy infrastructure to meet current and future power requirements of Fort Bliss El Paso TX. This research provides decision makers at Fort Bliss a framework for analyzing the projected cost savings of a Photovoltaic energy solution in reducing the Peak Energy Demanded from the existing electric utility, El Paso Electric Company. Additionally the research provides answers to the following questions.

1. Can photovoltaic solar power sufficiently meet the current and probable future additional power requirements of Fort Bliss, El Paso, TX?
2. Would it be cost beneficial for the DoD and industry to implement an ESPC utilizing photovoltaic energy to power Fort Bliss, El Paso, TX?

The analysis concludes that the projected cost savings does support a business case for the implementation of an Energy Savings Performance Contract Project at Fort Bliss, El Paso, TX for solely Photovoltaic Energy. The cost savings may vary widely depending on the ESCO proposal, availability and efficiency of the new photovoltaic power converter technology, the financing rate, payback period, and cancellation provisions. However, given the relatively conservative estimates contained in Chapter IV, a PV ESPC project at Fort Bliss can expect to generate annual savings of \$1,308,318. Based on an average financing rate of ESPCs at 8.07% the savings generated from a Photovoltaic array alone will be sufficient to meet the debt service payment and pay a reasonable profit of 16.8%.

Additional intangible savings that would be generated from an ESPC project include meeting the renewable energy goals of Executive Order 13123, lowering maintenance costs from existing infrastructure and lowering dependence on existing energy infrastructure.

The most current economical solution from our analysis is to fully fund a photovoltaic capital improvement project at Fort Bliss with military construction funding through the normal appropriations process. When comparing traditional full upfront financing versus an ESPC project, as seen in Chapter IV upfront financing can save approximately 40%. A June 2005 GAO analysis of six ESPC projects support this conclusion citing full funding is between 8-56% less expensive.⁵¹ However, the probability that funding would be secured in a reasonable timeframe, in the current resource constrained environment is very low. In addition, the government is responsible for maintaining, conducting, monitoring and the verification of the ECM in up-front financing. The Lawrence Berkeley study has shown government run ECMs average a 1-2% efficiency loss per year. ⁵² This efficiency loss further reduces the cost differences between ESPCs and traditional financing.

The ESPC process allows for the Federal Government to recapitalize aging energy infrastructure and benefit from improvements in energy efficiency in a much more expeditious manner than through the traditional acquisition process. The ESPC process shifts much of the risk of performance from the Government to the contractor, with the government only paying for actual savings. The Government also benefits from ESPC projects in maintenance of the implemented energy control measures as well. Under traditional services contracting after installation, the responsibility shifts to the government for maintaining equipment. In the use of an ESPC, the maintenance burden remains with the contractor to ensure a share in the savings.

⁵¹ June 2005 GAO Report "Performance Contracts Offer Benefits, But Vigilance is needed to Protect Government Interests. p. 16

⁵² Ibid., p. 29

3. Does the existing ESPC program policy allow for small companies with emerging photovoltaic technology to compete for these contract actions?

The current ESPC program requires contractors to pre-qualify as an Energy Savings Company in order to receive an ESPC project award. As evidenced by the list of DoE qualified Energy Savings Companies, the qualification process eliminates nearly all small businesses. Regional Super ESPCs under DoE and DoD have been awarded to only the largest of Energy Service companies, all with several thousand employees and market capitalizations exceeding \$500 Million. The small business standard that most closely resembles the ESCO industry, Engineering Services, has a size standard of \$25 Million.⁵³ As previously discussed, this size standard represents a contradiction between promoting new alternative energy technologies, largely in the hands of small entrepreneurial business, and implementation of these technologies in ESPCs, largely set aside for large energy service companies.

This contradiction is currently reconciled by small businesses being reliant on their large counterparts to bring new technologies into ESPC projects. This occurs at a cost in the form of reduced energy savings in ESPC projects due to anticipated financing costs. This cost would be borne by the Federal Government should they elect to initiate and ESPC project with a small business.

4. Are the requirements for certification as an Energy Saving Company too onerous on small businesses?

The certification process does not explicitly discriminate against small business. However, the certification process works against small business in several ways. First, the process is labor intensive, requiring submittal of a 15 page package answering numerous questions and detailing at a minimum two past energy savings project experiences, staffing levels, and other financial data. The process states that review of a certification package will require three months. These two requirements alone are enough to discourage participation by many small businesses. Small businesses may

⁵³ U.S. Small Business Administration Table of Small Business Size Standards
<http://www.sba.gov/size/sizetable2002.html>, Accessed 30 May 2006.

seek business opportunities in the less restrictive commercial sector. From a contracting agency perspective, this lengthy process also discourages contracting officers from encouraging companies to pre-qualify and take the path of least resistance by using Super ESPCs that have already been awarded. The contracting agency is only required to create a delivery order to be negotiated with the handful of Super ESPC ESCOs, thereby streamlining the contracting process.

Policies associated with the establishment of Super ESPCs and ESCO certification may be viewed as another form of contract bundling. These practices may limit competition to all but the largest of Energy Service companies, stifle innovation, and increase the cost of bringing new alternative energy technologies into ESPC projects.

B. RECOMMENDATIONS

This project evaluated current ESPC policy and conducted a cost benefit analysis for the implementation of photovoltaic energy at Fort Bliss. As a result of the research findings, analysis, and conclusions, the following six actions are recommended to improve ESPC implementation at Fort Bliss and overall ESPC project policy:

1. Verify ISG Array Savings

It is recommended that Fort Bliss verify the test results from the ISG array due out in July. As of this writing the technology was in Phase II testing. Final test results will provide a solid basis for a more accurate cost benefit analysis that will reveal more accurate savings estimates from a potential ESPC PV project at Fort Bliss. These test results will also serve to provide ESCOs a starting point for ESPC project proposals.

2. Conduct an Energy Audit

Fort Bliss should request an energy savings audit by the Federal Energy Management Program. The audit request forms are located on the FEMP website at the following link: http://www.eere.energy.gov/femp/services/assessments_savenergy.cfm.

The energy audit will provide Fort Bliss a baseline of energy costs and aid both Fort Bliss and potential ESCOs in assessing potential Photovoltaic projects.

3. Implement a Photovoltaic ESPC Project at Fort Bliss

The analysis supports the installation of a photovoltaic energy generation system at Fort Bliss through an ESPC project. It is recommended that once Fort Bliss has verified testing results from the ISG array due in July and conducted an Energy Audit, they should solicit proposals from ESCO's for a PV ESPC project under the U.S. Army Corps of Engineer's Super ESPC contract.

4. ESPC Contract Implementation

The analysis in the Chapter IV does support implementation of a PV ESPC project. For Fort Bliss to successfully implement any ESPC project the following recommendations should be considered:

a. Draft a Thorough Acquisition Plan

To effectively implement an Energy Savings Performance Contract project at Fort Bliss, a thorough Acquisition plan must be established. Fort Bliss can benefit from utilizing the expertise of the Department of Energy and the Federal Energy Management Program. The acquisition plan should incorporate best practices from other ESPCs, focusing on other Photovoltaic projects implemented within the Department of Defense and Federal Governments State and Local. Fort Bliss can also benefit from teaming with industry and inviting Energy Savings companies to comment on a Photovoltaic plan and incorporate other energy conservation measures for Fort Bliss given the results of the FEMP energy savings audit before issuing a solicitation.

A working level integrated product team should be implemented at Fort Bliss for the project to include the Base Command element, Contracting, Comptroller, Public

Works, Environmental, and Legal. Fort Bliss should also consider seeking a consultant from the Energy Sector to assist in reviewing Energy Service Company delivery order proposals.

b. Establish a Clear Measurable Energy Baseline

Determination of a clear, measurable baseline is vital to the success of any Energy Savings Performance Contract. The baseline must consider historical energy use at Fort Bliss and make reasonable projections of future energy demands. The baseline should be developed by the government or independently through hiring industry experts. The downfall of many ESPCs is a reliance solely on contractor's establishment of an energy baseline that may often be over inflated, leading to the erroneous guaranteed savings.

It is recommended that Fort Bliss' Energy Officer, as well as expertise from Federal Energy Management Program ESPC office and the Army Corps of Engineer's Super ESPC contracting team should be involved in establishing the baseline.

The baseline must also be flexible enough to allow for bilateral changes throughout the life of the contract. Changes to baseline must be considered for changes in scope. An example of such a change in scope would be the increased troop levels at Fort Bliss as a result of the Base Realignment and Closure Act. Baseline changes must also be considered for building closures, new facilities construction, and even additional concurrent ESPC projects that may affect lighting, HVAC, or other facilities that change overall energy consumption.

c. Measurement and Verification of Energy Savings

It is recommended Fort Bliss be directly involved in the Measurement and Verification process for all ESPC projects. Once a baseline is established a method for determining actual usage and energy savings must be agreed upon. The Government must be thoroughly involved in the measurement process to ensure energy savings are realized and measurable. As discussed in Chapter II, the GAO has cited many ESPC projects as failing to document the measurement of savings and relying solely on the

contractor to determine the actual savings rate.⁵⁴ It is recommended that an energy savings evaluation board be established to include members of the Fort Bliss' Energy Department, Contracting Office, and ESCO. This board would conduct periodic reviews of actual savings. The measurement of savings should be conducted jointly to ensure that all parties agree upon the determination of actual savings.

d. Super ESPC ESCO Teaming

It is recommended that Fort Bliss utilize the Army Corps of Engineer's Super ESPC for implementing a PV ESPC project. A significant hurdle in implementing the proposed new photovoltaic technology at Fort Bliss will be qualifying the holder of the proposed emerging technology as an Energy Savings Company to qualify under a Super Energy Savings Performance Contract. It is doubtful under current prequalification standards, specifically the experience requirements, whether the holder of the patent for this new photovoltaic technology would qualify as an ESCO. To expedite the implementation of an ESPC project using the new photovoltaic technology, the patent holder should be encouraged to enter a business relationship with an Energy Savings Company holding a current award under the U.S. Army's Corps of Engineers Super Energy Savings Performance Contract. The Super ESPC ESCO would bring its experience in other energy conservation measures that may make a viable business case for a comprehensive ESPC at Fort Bliss. A task or delivery order can be generated off the Army's existing Super ESPC contract, thereby greatly streamlining the implementation of the project.

Without the benefit of a qualified ESCO, Fort Bliss will be required to construct an Energy Savings Performance Contract outside of the Super ESPC process. This ESPC can be done but will require significantly more time and effort to implement. The expertise of the Federal Energy Management Program must be sought in drafting a proposal and implementing a project outside of the Super ESPC awards. The Army Corps of Engineers Super ESPC contract should be utilized as a model. The use of patented technology may justify the use of a sole source arrangement. As of the date of

⁵⁴ June 2005 GAO Report "Performance Contracts Offer Benefits, But Vigilance is needed to Protect Government Interests, p. 29

this writing the technology in question has not completed testing. The company contemplated for award must also be certified as an Energy Savings Company. As previously discussed this is a difficult process, requiring the company to document performance on previous energy savings projects and at least a three month review process before certification can occur.

e. Review Cancellation Provisions

It is recommended that Fort Bliss carefully review proposed Cancellation Provisions in all ESCO project proposals. In all ESPC projects the Government retains its right of termination for convenience or default under FAR Part 49. Along with termination, an ESPC must include a cancellation provision under FAR Clause 52.217-2, cancellation charges on multiyear contracts. The cancellation ceiling on an ESPC project is typically set at the total cost of the capital improvement and provides a reduction schedule corresponding with payments made under the ESPC. ESPC Project managers must ensure cancellation ceilings in excess of \$10 million are reported to Congress as required by law.⁵⁵ ESPC project managers should also review the cancellation provision reduction schedule throughout the project term. In certain instances it may be in the Government's best interest to exercise the cancellation provision before the end of the contract. Again project managers must consider that upon cancellation the title of the ECM is transferred to the Government and responsibility for the operations and maintenance shifts to the Government.

5. Energy Savings Performance Contract Policy

a. Recommend Creation of Centralized ESPC Database

Although GAO has criticized the Department of Energy's Federal Energy Management Program in multiple reports for not maintaining a centralized database to track ESPC projects, FEMP has been slow to respond. A lack of centralized database impedes the ability for agencies to share valuable lessons learned and make informed

⁵⁵ 42 United States Code 8287 from www1.eere.energy.gov/femp/docs/42_usc_8287_fs.doc, Accessed 30 May 2006

decisions that could lead to significant cost savings. Further, a centralized database could develop and track metrics that would allow the DOE to assess and better manage oversight of ESPC projects. Finally, a centralized database would increase the pool of potential financiers, and provide transparent data to more accurately assess risk and provide competitive rates commensurate with project risk.

b. Recommend limit award term of Super ESPCs

It is highly recommended that Super ESPCs be re-competed at a minimum of every five years. Re-competing Super ESPCs would not impact active delivery orders of current ESPC projects, but would serve to improve competition among certified ESCOs. The current environment makes it impossible for small businesses to break into the Super ESPC program. This environment where only the largest Energy Savings Companies have a virtual lock on Super ESPC stifles innovation and increases costs. More robust competition would serve to inject new technology and reduce overall costs.

The awarding of Super ESPC contracts has streamlined the implementation process of ESPC projects. However, this has come at a cost of limiting competition. For instance, under the DoE Western Region Super ESPC, four companies received awards. The DoE Western Region Super ESPC was awarded in May, 1997 and has not since been re-competed. This lack of re-competing alone is cause for concern. Although individual delivery orders under Super ESPCs are competed for by the qualified ESCOs, the competition can be considered limited at best.

c. Recommend Encourage Small Innovative Business Opportunities

It is recommended the DOE should establish a grant program to offset the current marketing fees ESCOs charge small business for teaming arrangements. As mentioned in Chapter III, Super ESCO's such as Sempra Energy charges 30% for partnering with a small business to bring their technology to market. The current ESCO selection process discourages participation by entrepreneurial firms. The Department of Energy must encourage partnering of ESCOs under regional Super ESPCs with small businesses

possessing emerging technologies in alternative energy. The current environment offers little incentive for small businesses that have been seen to be the leader in innovation, to compete for ESPC projects.

The current Super ESPC structure has discouraged many small businesses from competing. This is evident in reviewing the DoE's 2006 list of qualified ESCOs, which is dominated by large energy service providers.⁵⁶ The EPA act of 2005 passed additional energy tax incentives for energy efficient building improvements to commercial buildings. These incentives will continue to lure small business towards the commercial market and away from ESPC projects. DoE must act to improve the business environment for small businesses if the Federal government is to lead the way in implementing alternative energy solutions.

6. Recommend ESPC Training for DoD Contracting Officers and Project Managers

It is recommended that DoD seek out training in ESPC implementation and ESPC project management. The expertise on ESPC projects rests mainly with industry and subject matter experts at DoE. As a whole, the Government does not have the breadth of knowledge in energy service company operations and financing arrangements and is therefore at a distinct disadvantage when negotiating ESPCs. To successfully negotiate and implement an ESPC project, the contracting officer and installation project team must seek out additional training opportunities. Currently, there is no required training before embarking upon an ESPC project. FEMP, under DoE offers several ESPC training classes and FEMP-sponsored symposia that cover a myriad of topics concerning ESPC projects, from Super ESPC delivery order structure, to baseline determination, to financing arrangements. These conferences are an excellent way to obtain information concerning implemented ESPC projects, new alternative technologies, as well as

⁵⁶ DoE Qualified ESCO List from www1.eere.energy.gov/femp/pdfs/doe_ql.pdf, Accessed 28 March 2006.

facilitate the sharing of valuable lessons learned across projects and agencies. Training should be mandated for all contracting officers and installation project teams before embarking upon an ESPC project.

C. AREAS OF FURTHER RESEARCH

During the course of this research and analysis, the following topics that were outside the scope of this project and would require further examination to fully understand their impact on Energy Savings Performance Contract Projects must be evaluated.

1. Perform a business case analysis of establishing an Electric Cooperative within the Department of Defense. DoD installations in the Southwestern United States have the ability to produce excess solar power on large tracts of vacant land through a network of large ESPCs such as the one proposed in this project. By leveraging the solar ability of these installations, the DoD could provide inexpensive power to installations nationwide that are not located in the sunbelt. Currently statutory regulations allow the States to form Electric Cooperatives. Research would explore the ability for DoD to form an Electric Cooperative to transfer energy on the national energy grid to provide significant energy savings.

2. Compare Municipal, University, Schools, and Hospital Energy Savings Performance Contracts (MUSH) with Federal projects. The MUSH community has embarked upon significantly more projects than the Federal Government and specifically the DoD. The data available from the breadth of projects and greater elapsed time from implementation of MUSH projects may yield additional lessons learned for implementation of projects within DoD. These available data are particularly true of University projects with their average project size closely resembling the size of DoD Installations.

3. Perform a business case analysis of an existing Department of Defense Energy Savings Performance Project. The GAO has highlighted the need to thoroughly analyze the performance of existing ESPC projects. Although several cursory articles have been

written touting the success of ESPC projects, a thorough analysis of individual ESPC projects is lacking. Focused research on a single ESPC project will lead to a thorough understanding of the financing of the project, monitoring of contractor performance, and lead to lessons learned. The project could generate identifiable metrics that could be adopted by the Department of Energy and the FEMP program for creation of a centralized database and uniform reporting on ESPC projects. This database should incorporate best practices and lessons learned across the Federal Government for ESPC project implementation auditing and administration.

APPENDIX A-GHP DOE SUPER ESPC CONTRACT SECTIONS

PART I C THE SCHEDULE SUPPLIES OR SERVICES AND PRICES/COSTS

B.1 ITEMS BEING ACQUIRED/TOTAL PRICE

The Contractor shall furnish all personnel, facilities, equipment, material, supplies, and services (except as may be expressly set forth in this contract as furnished by the Government) and otherwise do all things necessary for, or incident to, performance of the following items of work:

Item 1 - Provide Energy Savings Performance Contracting (ESPC) conservation services, including Geothermal Heat Pump (GHP) measures, for federal Government facilities located in the United States and its territories, and for federally-owned facilities located in overseas locations, although not in the United States and its territories.

The services shall be provided in accordance with not only the Statement of Work provided in Section C, Description/Specifications/Work Statement, of this contract, but also in accordance with all provisions in other sections of this contract, as well as all of its Attachments, and as revised by agency delivery order requests for proposal (DO RFPs). (See Section H.19 for more specific information.) Definitions of terms applicable to this contract are provided at Attachment 1 to the contract, for assistance in its performance.

(NOTE: There are no Reporting Requirements included in this contract for delivery orders issued against this Indefinite Delivery/Indefinite Quantity (IDIQ) contract award. The ordering agency for a specific delivery order project will include the actual reporting requirements in each specific delivery order issued against this contract. Attachment 2 to this contract provides a Sample Reporting Requirements Checklist for Delivery Orders.)

THE TOTAL MAXIMUM CONTRACT VALUE, defined as the sum of contractor payment streams associated with all delivery orders against the IDIQ contracts awarded for these efforts, shall not exceed \$500,000,000.00.

THE MINIMUM GUARANTEE ORDER (S) VALUE for this specific IDIQ contract award is \$150,000.00.

B.2 REQUIRED SERVICES

The Government requires ESPC conservation services for federal Government facilities located as described in Section B.1, Item 1 above, and seeks to obtain these services using this indefinite delivery indefinite quantity energy savings performance contract (IDIQ ESPC).

The contractor shall provide, at no capital cost to the Government, all labor, material, and equipment necessary to provide Geothermal Heat Pump energy supply systems and related energy efficiency measures to reduce energy and water consumption, and provide energy cost savings and related operation and maintenance cost savings, at specific sites covered by delivery orders issued against this IDIQ contract. Contracted delivery order services may also include operations and maintenance services during a specific delivery order term as required in Section C or elsewhere of this contract, the specific delivery order, and/or as proposed by the contractor and accepted by the Government in a delivery order award.

B.3 FAR 52.216-22 (MODIFIED) INDEFINITE QUANTITY (OCT 1995)

This is an indefinite quantity contract for the supplies or services specified, and effective for the period stated, in the Schedule. The quantities of supplies and services specified in the Schedule are estimates only and are not purchased by this contract.

Delivery or performance shall be made only as authorized by orders issued in accordance with the Ordering clause. The contractor shall furnish to the Government, when and if ordered, the supplies or services specified in the Schedule up to and including the quantity designated in the Schedule as the "maximum". The Government shall order at least the quantity of supplies or services designated in the Schedule as the "minimum."

Except for any limitations on quantities in the Order Limitations clause or in the Schedule, there is no limit on the number of orders that may be issued. The Government may issue orders requiring delivery to multiple destinations or performance at multiple locations.

Any order issued during the effective period of this contract and not completed within that period shall be completed by the contractor within the time specified in the order. The contract shall govern the Contractor's and Government's rights and obligations with respect to that order to the same extent as if the order were completed during the contract's effective period.

B.4 FAR 52.216-18 (MODIFIED) ORDERING (OCT 1995)

(a) Any services to be furnished under this contract shall be ordered by issuance of delivery orders by an authorized Contracting Officer for a United States Government federal agency (Agency Contracting Officer). Agency Contracting Officers shall submit draft delivery order requests for proposals and draft delivery orders, prior to issuance, to the DOE Contracting Officer for this contract to obtain his/her review and suggestions/comments.

(b) Such orders may be issued beginning on the date of contract award through October 1, 2003. At the Government's discretion, the ordering period may end on this date, which is the current limitation on ESPC ordering authority, as indicated in P.L. 105-

388, dated November 13, 1998. However, at any time during the contract term defined in Section F.1.1, the Government may unilaterally modify the contract to extend the ordering period.

(c) All delivery orders are subject to the terms and conditions of this contract, except as modified by the terms and conditions of a specific delivery order request for proposal, as permitted by the contract. In the event of a conflict between the terms and conditions of a delivery order and those of this contract, the delivery order provisions will take precedence. (Also see Section C.1.)

(d) If mailed, a delivery order is considered "issued" when the Government deposits the order in the mail. All delivery orders shall be in writing, and duly signed by an authorized Agency Contracting Officer, as defined in subparagraph (a) above.

B.5 FAR 52.216-19 (MODIFIED) ORDER LIMITATIONS (OCT 1995)

The Government estimates it will procure, and thereby establishes as a maximum order amount for the total of all (4) contracts awarded, a not-to-exceed \$500,000,000 of ESPC services during the terms of the contracts awarded (see Section B.1). Also, the Government guarantees that a minimum of \$150,000 of ESPC services shall be awarded to the contractor during that same 25-year term. (See the limitation on ordering at Section B.4(b).). Therefore, the Government is not obligated to purchase from the contractor services that exceed a total value of \$150,000. (This value of services may be represented by anything from a single delivery order for one project, to a number of delivery orders for various projects.) The Contractor is likewise never obligated to provide offers for specific proposed delivery order projects, accept orders, or furnish services against this contract.

Notwithstanding paragraph (a) of this section, the Contractor shall honor any order received, including orders exceeding the maximum order limitation identified in paragraph (a), unless that order (or orders) is returned to the Agency Contracting Officer within thirty (30) days after issuance, with written notice stating the Contractor's intent not to provide the services called for, and the reasons therefore. Upon receiving this notice, the Government may acquire the supplies or services from another of the multiple-awardee Contractors for this DOE region.

B.6 NEGOTIATED CONTRACT B SCHEDULES

The contract includes these negotiated schedules, the information in which shall be binding on the Contractor throughout the period of performance (overall term) of the contract. These schedules apply to all delivery orders issued against the contract. Following are the titles of each of these contract B schedules. They are made a part of this contract, in Part III, Section J, Attachment 3.

SCHEDULE B-1 IDIQ Contract Maximum Markups

This Schedule provides the negotiated maximum markup percentages applicable to the both the direct costs of ECMs by technology category identified in Section C.2 and included in the Schedule DO-2 for a project proposal, and to the performance period expenses identified on the Schedule DO-3 for the proposal. These markups shall include all proposed indirect cost elements and profit. The indirect elements of expense in the markups include such things as overhead, general and administrative expense, general program marketing and management, etc. Any project expenses that are not directly the result of the development and implementation of an individual project are included in the markups, and they shall not include any direct expenses. The Contractor shall identify the elements of indirect expense included in the proposed markup for a specific delivery order project.

SCHEDULE B-2 IDIQ Contract Maximum Added Premiums

This Schedule provides the negotiated maximum added premiums, as the number of basis points (basis point = 1/100 percentage points) that may be applied to the accepted applicable financial index used for a specific delivery order project to finance the project's investment amount. (The negotiated added premium plus the accepted applicable financial index equals the project's interest rate.) Per the schedule, the maximum added premiums are based on both the project term and total investment amount of the project. The Contractor shall provide evidence to the Agency Contracting Officer of the reasonableness of the added premium proposed for a specific delivery order project within the maximums allowed.

SECTION C DESCRIPTION/SPECIFICATIONS/WORK STATEMENT

C.1 GENERAL REQUIREMENTS/PROJECT SCOPE

This contract is to acquire under an energy savings performance, indefinite delivery/indefinite quantity contract, GHP-centered energy conservation services to reduce energy and water efficiency measures and to reduce associated utility costs (and related operations and maintenance costs) as specified in each delivery order issued against this contract. The Contractor shall be responsible for providing all labor, material, and capital to install the GHP-centered projects and provide operations and maintenance as specified in each delivery order. The cost of the GHP-centered and ECM project(s) must be covered by the reduced energy and related operation and maintenance cost savings incurred at the Federally-owned facility. The non-renewable energy cost savings provided by a delivery order project against this contract must be verified annually.

The subsequent sections of this IDIQ contract do not make special mention of the required GHP content of delivery orders, but rather it considers GHP as one of the technology categories allowed under the scope of this contract (See Section C.2).

The scope of this IDIQ contract includes all federally-owned facilities located as described in Section B.1 above. The IDIQ contract may be used by authorized Federal

agencies to acquire energy conservation measures in accordance with the ordering procedures found at Sections H.20 through H.26 of this contract.

All provisions that follow throughout the remaining sections of this contract may be revised within the overall scope of the contract as necessary (based on the needs of an agency) in an Agency Delivery Order Request for Proposal (DO RFP), unless noted otherwise in this contract at the specific provision. In the event of a conflict between the DO RFP and the IDIQ, the provisions of the DO RFP will prevail. (See more specific information at Section H.19.)

C.2 ENERGY CONSERVATION MEASURES (ECMs)

C.2.1 Types of Energy Conservation Measures

All delivery orders under this contract, without exception, shall include on one or more members of the family of proven geothermal heat pump (GHP) systems. The GHP system is defined to include all components required to achieve a fully functional system for its intended purpose which generally includes, but is not limited to, heating, ventilation and air conditioning (HVAC) and/or water heating.

ECMs in associated technology categories are also encouraged under the IDIQ contract. When implemented in the same project with GHPs, such ECMs result in a decrease in the required GHP capacity and/or an increase in overall GHP system efficiency, and enable the federal site to capture all of the economically obtainable cost savings made possible by the GHP portion of the project. This contract and its delivery orders may therefore include ECMs in the following associated technology categories:

GHP Systems

The cost of optimized GHP-centered and other ECMs must be covered by the reduced energy and related operation and maintenance cost savings incurred at the federally-owned facility. Following are examples of acceptable source of reduced energy and related operations and maintenance costs that can be considered for GHP-centered systems:

- (1) Potentially avoidable costs:
 - (a) Fuel or utilities energy costs for the conventional system being replaced. This included all types of fuel. If the replacement system saves water, the cost of the water saved can be included.
 - (b) The cost of all materials and labor used to maintain the system being replaced. This would include the cost of oil, filters, replacement parts, etc.
 - (c) The cost of fuel transport. This includes the cost of labor to transport fuel, the cost of the fuel to power the vehicle to transport the fuel, and the cost of the maintenance of the vehicle.

- (d) The cost of (UPS) systems or batteries, or other methods to maintain reliability of the conventional system being replaced by the GHP system.
- (e) The cost of ratchet charges or peak demand charges from a utility company, to the extent the GHP system will carry the load during the peak periods.
- (f) The cost of savings resulting from the application of a lower cost unit rate due to improvement of the load power factor from the application of the GHP system.
- (g) For a site that is scheduled to be developed, as long as the GHP system is replacing another system which was planned and budgeted for, the avoided cost of building, designing and installing the alternative system is an acceptable cost savings.
- (h) The cost of personnel to operate a conventional energy system during a critical experiment or activity or time of day.
- (i) The cost of trenching, patching and diverting traffic to install, upgrade or repair a conventional system.

(2) Contingencies based on probability of future costs:

- (a) If an agency has budgeted for contingencies, such as a possible fuel spill, and the GHP system will eliminate the need for this contingency, the present value of such a budgeted item is a cost savings. If the agency does not budget for such contingencies, then it is not a cost savings.
- (b) If the agency has budgeted for upgrades and overhauls of the conventional system (such as replacing an electric line or replacing underground fuel storage tanks with above ground tanks) and this expense would be avoided by the GHP system, the present value of the budgeted amount is considered a cost savings.

(3) Environmental Externalities:

If the GHP system provides a means to offset the cost of air emissions permits or impending fines, these offset costs are considered cost savings.

2. Conventional HVAC, such as, but not limited to packaged air conditioning unit replacements HVAC damper and controller repair or replacement replacement of air conditioning and heating units with heat pumps, window air conditioning replacement with high efficiency units, cooling tower retrofits or replacements economizer installation fans and pump replacement or impeller trimming, thermal energy storage variable air volume (VAV) retrofit.

3. Building Automation Systems (BAS) / Energy Management Control Systems (EMCS), such as, but not limited to HVAC control upgrade from pneumatics to Direct Digital Control (DDC) Upgrade or replacement of existing EMCS systems.

4. Lighting Improvements, such as, but not limited to interior and exterior lighting replacements lighting control improvements occupancy sensors installation LED exit sign installation Daylighting.

5. Building Envelope Modifications, such as, but not limited to insulation installation, weatherization, window replacement, reflective solar window tinting.
6. Electric Motors and Drives, such as, but not limited to motor replacement with high efficiency motors variable speed motors or drives.
7. Appliance/Plug Load Reductions, such as, but not limited to replace air-cooled ice/refrigeration equipment with premium efficiency water-cooled equipment connected to the GHP common loop replace refrigerators with premium efficiency refrigerators de-lamp vending machines place plug timers on appliances and/or equipment.
8. Central Utilities Modifications, such as, but not limited to boiler/chiller modifications/replacement so that the remaining load is satisfied as efficiently as possible isolation valves on steam, hot water or chilled water lines no longer needed transformer right-sizing, power factor correction, etc. so that the remaining electrical load is satisfied as efficiently as possible piping insulation installation hot water heaters repair and replacement steam trap repair and replacement power quality upgrades power factor correction gas distribution systems installation.
9. Water and Sewer Conservation Systems, such as, but not limited to installation of low flow showerheads installation of low-flow plumbing equipment installation of water efficient irrigation installation of on-site sewer treatment systems.
10. Electrical Peak Shaving/Load Shifting, such as, but not limited to thermal energy storage, gas cooling demand limiting controls.
11. Energy Cost Reduction Through Rate Adjustments, such as, but not limited to recommendations for change to more favorable rate schedule recommendations for Government negotiation of lower rates, same supplier recommendations for lower energy cost supplier(s) (where applicable) energy service billing and meter auditing recommendations.
12. Proposal Development Energy Surveys, such as, but not limited to detailed energy surveys feasibility studies.

C.2.2 Restrictions on proposed ECMs

ECMs installed by the Contractor shall not:

1. Jeopardize the operation or environmental conditions of dedicated computers or computer rooms;
2. Increase water consumption; e.g., once through fresh water cooling systems (Note: evaporative cooling technologies may be considered where environmentally appropriate);

3. Result in an adverse effect upon the quality of the human environment or violate any Federal, State, or local environmental protection regulations;
4. Degrade performance or reliability of existing Government equipment;
5. Reduce extra capacity that was intentionally included for future growth, mobilization needs, safety, or emergency back-up;
6. Violate current versions of national codes (e.g., National Electric Code, Uniform Building Code, etc. , State or local building codes; See Section C.5.2); or
7. Creates unsafe conditions or otherwise adversely impacts government facilities, operations, and/or personnel;

Any additional restrictions on ECMs will be specified in delivery orders issued against the contract.

C.2.3 Contract Requirements for ECMs

Installed ECMs shall comply with the contract requirements, and/or with the requirements of each delivery order. Contract requirements also incorporate all Government-approved Contractor submittals, including: equipment design and installation specifications, compliance with codes and standards, design drawings, installation schedules, startup and testing procedures, operation and maintenance procedures, and any other submittals required by delivery orders issued against the contract.

C.3 FACILITY PERFORMANCE REQUIREMENTS OF ECMs

Installed ECMs shall meet the performance requirements specified below:

C.3.1 Environmental & Lighting Conditions: Modifications to building lighting systems and environmental control systems shall not be permitted to exceed the ranges for Standards of Service specified in Paragraph C.3.2. Where automated controls of lighting or environmental conditions are to be installed, the occupants must have the ability to override the system.

C.3.2 Standards of Service: Installed ECM's shall comply with the Standards of Service required for facilities as specified in each delivery order. The standards of service will include acceptable temperature and humidity ranges, air quality parameters, lighting levels, and other related factors.

C.3.2.1 GHP Systems

(a) Occupied Areas:

Comfort Range:

65E - 78EF dry bulb
30% - 60% relative humidity

2. In general occupied areas (except computer rooms) the following setbacks may be performed: During unoccupied periods during the heating season, the temperature may be reduced to 55EF dry bulb. During unoccupied periods during the cooling season, the HVAC system may be turned off. However, the system must be designed so that it will restart if the temperatures approach levels that could damage equipment. In any case, temperatures must be restored to the 65E - 78EF dry-bulb range by the start of the next occupied period.

3. Outside air cannot be reduced below the quantities cubic feet per minute (CFM) per person value found in ASHRAE 62-89 (or most current version), "Ventilation for Acceptable Indoor Air Quality".

(b) Computer Rooms

1. Operating Range:

70E - 74EF dry bulb (or based on Mfr. specs)
45% - 55% relative humidity

2. No environmental control system temperature setbacks will be allowed in computer rooms.

The GHP control system must be compatible with the present energy management control system. Thermostatic tolerance must be within plus or minus one degree Fahrenheit for all areas listed in C.3.2.1 (b) and plus or minus two degrees Fahrenheit for areas in C.3.2.1 (a). Any system temperature change required for the operating rooms must not exceed 1 degree F in five (5) minutes.

(d) Hospitals and other special areas may have special requirements as specified in the delivery order.

C.3.2.2 Lighting Systems: Except where special circumstances exist, illumination levels shall be maintained as near as practical to the Illuminating Engineering Society of North America (IES) recommended illumination level.

C.4 MEASUREMENT AND VERIFICATION OF ECM PERFORMANCE

Every delivery order awarded shall include a site-specific Measurement & Verification (M&V) Plan that specifies the M&V requirements and procedures that shall apply to the delivery order based on various factors such as type of ECMs, projected value of energy savings, certainty/uncertainty of savings being achieved, and the intended risk allocation between the Federal agency and the Contractor.

The delivery order M&V plan shall specify the M&V options(s) and method(s) that will be used for each ECM included in the delivery order. M&V options and methods proposed for each ECM shall comply with the latest version of the DOE/FEMP M&V Guideline for Federal Energy Projects in effect at the time of delivery order award.

C.4.1 M&V Activities

The Contractor shall perform the following required M&V activities:

1. Define a site-specific M&V plan for the particular project being installed once the project has been fully defined and the detailed energy survey is completed; this will occur before the delivery order is awarded and the plan will be incorporated into the delivery order.
2. Define pre-installation baseline including (a) equipment/systems, (b) baseline energy use, (c) system performance factors (e.g., lighting levels, temperature set points, time clock settings, etc.), and/or (d) actions to determine baseline energy use, which may include site surveys, short term or long term metering, analysis of billing data, and/or engineering calculations. The definition of pre-installation baseline should occur before the delivery order is awarded.
3. Define post installation conditions including (a) equipment/systems, (b) post installation energy use and/or (c) actions to determine post installation energy use which may include site surveys, short-term or long-term metering, analysis of billing data, and/or engineering calculations, and (d) factors beyond the contractor control that influence post-installation energy (e.g. building occupancy, plug load creep, etc.).
4. Conduct annual M&V activities to verify operation of the installed equipment/systems and/or calculation of current year's energy savings.

C.4.2 M&V Submittals During Delivery Order Development and Post Award

1. The Contractor shall prepare and submit a general M&V approach (AM&V Overview@) with its Initial Proposal, identifying the M&V options and methods to determine pre-installation baseline and post-installation ECM performance for each proposed ECM (see Section H.21(c)).

2. The Contractor shall prepare and submit an M&V Overview and Specific M&V Plan with its final proposal per requirements of Section H.24.1 B. Included in the specific M&V plan will be a project schedule indicating ECM installation, M&V activities, and post-award M&V reporting milestones. M&V report milestones should include post-installation M&V reports associated with ECM installation inspection and commissioning, and periodic (at least annually) ECM performance M&V reports.
3. The Contractor shall prepare and submit a Post-Installation M&V report, to verify that installed ECMs demonstrate the potential to deliver the guaranteed annual energy and energy-related cost savings specified in the awarded delivery order. The contents of the Post-Installation Report will be as specified in the Specific M&V Plan approved by the Government and included in the delivery order. The Post-Installation M&V report shall be submitted in accordance with the schedule provided in the Specific M&V plan.
4. The Contractor shall prepare and submit an Annual M&V Report (or other period agreed to in the specific M&V Plan) including data and calculations that provide evidence that continued ECM performance achieves the guaranteed annual energy and energy-related cost savings in the delivery order. The contents of the periodic M&V report should include ECM performance measurements, calculations and adjustments to baselines as applicable and agreed to in the specific M&V Plan. Annual (periodic) M&V reports shall be submitted in accordance with the schedule provided in the specific M&V Plan.

C.5 INSTALLATION REQUIREMENTS FOR ECMs

NOTE: Once negotiated and awarded, a delivery order is a fixed-price design/build energy project. Changes to meet design or performance requirements of the delivery order shall be at no cost to the Government. Changes in contractor cost due to Government changes to delivery order requirements will be negotiated as changes.

C.5.1 Design and Construction Package

1. The Contractor shall prepare and submit a design and construction package to the Federal agency for review and approval prior to starting ECM installation in accordance with the delivery order reporting requirements checklist. The design and construction package shall be certified by a registered engineer to assure compliance with applicable building codes and Federal agency design standards. The delivery order will specify site specific requirements of the design and construction package. The Contractor is responsible for the technical adequacy of its work. Acceptance of the design and construction package by the Government shall not relieve the Contractor from responsibility for adequacy of its design and installation work.

2. The design and construction package due date will be specified in the delivery order reporting requirements checklist. Upon approval of the design and construction package, bonds may be required in accordance with Section H.17.

3. The design and construction package shall be prepared and include at least the following:

Manufacturer's Data For all ECM equipment to be installed the Contractor shall provide the manufacturer's descriptive literature of equipment including drawings, diagrams, performance and characteristic curves, and catalog cuts.

b. **Design Specifications** The Contractor shall identify and reference design specifications applicable to installed ECMs.

c. **Construction Drawings** Construction drawings shall be prepared by the Contractor, subcontractor, or any lower-tier subcontractor showing in detail:

§ The installation (i.e., form, fit, and attachment details) of the interface between ECM equipment and existing Government equipment.

§ The location of installed equipment on building floor plans.

§ **Certification of ECM Compliance with Building Codes and Standards.** The Contractor shall provide registered engineer certification that ECMs comply with all applicable building codes and standards. ECM installation plans submitted to the Agency Contracting Officer without evidence of the professional engineer (PE) certification shall be returned for resubmission.

d. **Planned Service Interruptions** If any utility services must be discontinued temporarily to perform work, such interruptions shall be described and indicated on the project installation schedule. The description shall include the length of the interruption, its time (date, day of week, time of day, etc.), and a justification.

e. **Site Plan and Compliance with Federal Site Exterior Architectural Plan** If an ECM involves the installation of facilities or exterior structures, the Contractor shall provide a site plan showing its location, or show its location on the Government's existing site plan. The Contractor shall also provide a plan and elevation drawings of the facility or exterior structure showing its size and exterior appearance.

f. **Acquisition of Permits** For any ECM installation requiring permits from regulatory agencies (i.e., hot-work permit for welding), the Contractor shall provide its plan and schedule for acquiring such permits.

g. **Installation Schedules** The installation schedule shall show the order in which the Contractor proposes to perform the work and the dates on which the Contractor

contemplates starting and completing all major milestones (including acquiring materials, equipment, permits). The schedule shall be in the form of a progress chart of suitable scale to indicate the amount of work scheduled for completion by any given date during the installation period.

4. Design documents will require both a preliminary and final review by the Agency. Each delivery order will specify the submittal requirements associated with each review.

C.5.2 Design and Construction Standards

1. A Delivery Order issued against this IDIQ contract award will specify design and construction standards applicable to site or agency specific facility requirements. At a minimum, all ECMs, work, equipment and materials required for ECM installation shall comply with the most recent issue of the design and construction standards indicated in the delivery order as applicable. The following list of standards is provided as a guideline for establishing these requirements.

- \$ American National Standards Institute (ANSI)
- \$ Code of Federal Regulations (CFR)
 - 29 CFR 1910 Occupational Safety and Health Standards
 - 10 CFR 435 Energy Conservation Voluntary Performance Standards for Commercial and Multi-Family High Rise Residential Buildings
 - 29 CFR 1926 Safety and Health Regulations for Construction
- \$ National Electric Code (NEC)
- \$ National Electrical Safety Code (NESC)
- \$ National Fire Protection Association (NFPA) Standards including, but not limited to NFPA 101 - Life Safety Code
- \$ National Electrical Manufacturers Association (NEMA).
- \$ Underwriters Laboratory (UL).
 - \$ Uniform Building Code (UBC)
- \$ Uniform Plumbing Code (UPC)
- \$ American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - ASHRAE 90.1
- \$ Army Corps of Engineers Safety Manual
- \$ National Electrical Manufacturers Association (NEMA)
- \$ National Historic Preservation Act, as applicable
- \$ Illuminating Engineering Society of North America (IES)
- \$ American Institute of Architects (AIA) Masterspec
 - \$ Air Conditioning and Refrigeration Institute (ARI)
- \$ Occupational Safety and Health Administration regulations
- \$ Other design standards required by the ordering Federal Agency

2. No requirement of this contract shall supersede applicable regulations, local codes and/or standards. Any violation of such regulations and standards shall be brought to the attention of the Agency Contracting Officer for clarification prior to proceeding with the work.

3. If conflicts between designated applicable codes and/or standards exist, the Agency Contracting Officer's Representative and applicable authority having jurisdiction shall determine the appropriate code to follow.

C.5.3 ECM Quality Control Inspection Program

1. The Contractor shall be responsible for quality control during installation of ECMs. The Contractor shall inspect and test all work performed during ECM installation to ensure compliance with the delivery order's performance requirements. The Contractor shall maintain records of inspections and tests, including inspections and tests conducted by or for utility or other regulatory agencies. The Contractor shall prepare a Quality Control

Inspection Program for review and acceptance by the Government. The ECM Quality Control Inspection Program shall be prepared and submitted in accordance with the delivery order reporting requirements checklist.

2. The ECM Installation Quality Control Inspection Program shall detail the procedures, instructions, and reports that ensure compliance with the delivery order and this IDIQ contract. This plan shall include as a minimum:

a. The quality control organization, in chart form, showing the relationship of the quality control organization to the Contractor's organization.

b. Names and qualifications of personnel in the quality control organization.

c. Area of responsibility and authority of each individual in the quality control organization.

d. A listing of outside organizations, such as testing laboratories, architects, and consulting engineers that will be employed by the Contractor, and a description of the services these firms will provide.

e. Procedures for reviewing all shop drawings, samples, certificates, or other submittals for delivery order and indefinite quantity contract compliance, including the name of the person(s) authorized to sign the submittals for the Contractor, as complying with the delivery order and indefinite quantity contract's requirements.

f. An inspection schedule, keyed to the installation schedule, indicating necessary inspections and tests, the names of persons responsible for the inspections and tests, and the time schedule for each inspection and test.

g. The procedures for documenting quality control operations, inspection, and testing, with a copy of all forms and reports to be used for this purpose. The Contractor shall include a status log listing all submittals required by the inspection plan and stating the action required by the Contractor or the Government. The Contractor shall also prepare and maintain a testing plan that shall contain a listing of all tests required by the delivery order and/or IDIQ contract requirements.

h. The Quality Control Inspection Program Plan shall be submitted to the COR for review and approval as a separate stand-alone document after award of the delivery order, along with the required Design and Construction Package. The initial Government review will be completed within fifteen (15) working days of its receipt. The Contractor shall then submit any revisions within fifteen (15) working days after receipt of the Government's notice or request for clarification. After receipt of the requested revised contractor information, the Government's review and approval shall be completed within fifteen (15) working days.

C.5.4 Installed ECM Commissioning

The Contractor shall include a commissioning plan detailing performance of design review, start-up, testing, and interactive performance assurance standards for all Contractor-installed and Government-owned equipment impacted by the ECMS installed. The commissioning approach shall draw upon procedures established for commissioning Federal Buildings as outlined in the Building Commissioning Guide 2.1 available at: www.eren.doe.gov/femp/techassist/bldgcomgd.html

The Contractor shall submit a Commissioning Plan as a stand-alone document in accordance with the delivery order reporting requirements checklist. Commissioning shall be completed and documented as part of the Post-Installation M&V Report.

C.5.5 Environmental Protection

ECMs shall cause no adverse impacts upon the quality of the human environment. Impacts on air quality (pollutants, noise level, and odors or fumes) and potable water use are examples of potential areas of concern at the project site. Any planned building modifications shall comply with the National Environmental Policy Act (NEPA) and other applicable Federal, state, and local environmental protection regulations. The delivery order will identify specific known hazardous waste handling and storage requirements (e.g., PCB ballasts removed from lighting fixture retrofits).

The contractor shall comply with applicable Federal, state and local laws and with the applicable regulations and standards regarding environmental protection. All environmental protection matters shall be coordinated with the Agency Contracting Officer. Authorized Government officials may inspect any of the contractor's work areas on a no-notice basis during normal working hours. In the event that a regulatory agency

assesses a monetary fine against the Government for violations caused by contractor negligence, the contractor shall reimburse the Government for the amount of any fine and other related costs. The contractor shall also clean up any oil spills, hazardous wastes, and hazardous materials resulting from the contractor's operations. The contractor shall comply with the instructions of the cognizant Federal agencies' safety and health personnel to avoid conditions that create a nuisance or which may be hazardous to the health of Government or civilian personnel.

The contractor shall prepare at its expense all documentation necessary to acquire permits to comply with all applicable Federal, state and local requirements prior to implementing affected ECMs in the performance of a delivery order. The contractor shall not receive a notice to proceed with installation until all environmental protection requirements contained in the IDIQ contract and a delivery order have been satisfied.

The contractor shall comply with 40 Code of Federal Regulations (CFR) Section 311, and with the requirements of the latest edition of the applicable Federal agency's Spill Prevention Control and Countermeasures Plan, as required by a delivery order.

C.5.6 Service Interruptions

1. For any planned utility service interruptions, the Contractor shall furnish a request to the Agency Contracting Officer's designated representative for approval at least fifteen (15) working days in advance or as specified in the delivery order. The request shall identify the affected buildings and duration of planned outage.
2. The Government will coordinate with affected tenants and customers as applicable.
3. If the discontinued service is due to any emergency breakdown, the Contractor shall notify the Agency Contracting Officer's designated representative as soon as possible and the Government will notify those affected tenants and customers as applicable.
4. Federal agencies may have additional requirements that apply to specific delivery orders, and if applicable, will be specified in the delivery order. These additional requirements may include liquidated damages for violations of service interruption provisions.

C.5.7 As-Built Drawings

After completion of installation and Government acceptance of installed ECMs, the Contractor shall submit as-built drawings to the Agency Contracting Officer or his/her designated representative in accordance with agency standards or specifications identified in the delivery order.

C.6 OPERATION OF ECMs

C.6.1 Operations work includes all work and costs (excluding energy costs) associated with operating energy producing and consuming systems. The operations work effort shall include operations tasks at specific stations, continuous or periodic equipment monitoring, and minor on-line equipment adjustments required to achieve all facility and energy conservation performance requirements of this contract.

C.6.2 The Contractor shall be responsible for operation of all ECMs installed. Installed ECMs shall include all contractor installed equipment and those portions of Government equipment which have been modified or replaced to achieve proposed ECM performance. Examples of exceptions that may be specified in a delivery order are:

1. If the new operations work requirement for Contractor installed ECMs is similar to an existing operations work requirement for Government owned equipment and does not have an impact on Government resources, the Contractor may request that the Government perform operations work on Contractor installed equipment. The Government reserves the right not to accept operations work on installed ECMs.
2. The Contractor finds it advantageous and proposes to assume responsibility for an operation of existing Government-owned equipment to ensure that the ECM will be implemented properly and achieve proposed ECM performance. Any operations work provided by the Contractor on existing Government-owned equipment shall be at the Contractor's expense.
3. The Government currently utilizes bargaining unit employees, contracted services, or in-house labor and considers it advantageous to perform operations of the installed ECMs.

C.6.3 When the implementation of an ECM results in a change in an existing operations work affecting Government or contractor equipment, the Contractor shall prepare a new written operations work procedure for approval by the Government. The due date for the operations work procedure will be specified in the delivery order reporting requirements checklist. The Contractor shall train Government personnel in the new approved operations work procedure. The Government will permit its personnel to attend training sessions at reasonable times on the specific project site's premises.

C.6.4 If the Government assumes proposed operations in C.6.2.1 or C.6.2.3 above, the Government will use and operate government-owned equipment, and contractor equipment, in accordance with operating procedures provided by the Contractor and approved by the Agency Contracting Officer. The Contractor shall monitor and continue to be responsible for equipment performance. Under the O & M section of the Contractor's Management Plan, the Contractor shall provide a description of how he

plans to coordinate with, monitor, and verify implementation of the Contractor provided operating procedures by Government or contracted operations personnel.

C.6.5 The Government will not move, turn off, or otherwise change any Contractor-owned equipment without the consent of the Contractor, unless such action is in accordance with the operation procedures provided by the Contractor; or if it is necessary in an emergency to prevent loss of life, injury or damage to property, or severe discomfort to Government personnel, occupants, or patients.

C.7 MAINTENANCE OF ECMs

C.7.1 Maintenance work includes all work and costs associated with maintaining the energy producing and consuming systems. Maintenance work includes periodic equipment inspections, tests, calibrations, preventative maintenance tasks, and corrective maintenance actions required to ensure systems operate as intended.

C.7.2 The Contractor shall be responsible for maintenance of all ECMs installed. Installed ECMs shall include all contractor installed equipment and those portions of Government equipment that have been modified or replaced to achieve proposed ECM performance. Examples of exceptions that may be specified in a delivery order are:

1. If the maintenance work is similar to an existing maintenance work requirement for Government-owned equipment and does not impact on Government resources, the Contractor may request the Government in its proposal to perform maintenance work on Contractor-owned equipment. The Government reserves the right to not accept the proposed responsibility for maintenance work on installed ECMs.
2. The Contractor proposes to assume responsibility for maintenance on Government-owned equipment in order to achieve proposed ECM performance. The Contractor may propose to provide either total maintenance or a level of maintenance needed to augment the existing maintenance provided by the Government. Any maintenance work provided by the Contractor on government-owned systems or equipment shall be at the Contractor's expense.
3. The Government currently utilizes bargaining unit employees, contracted services, or in-house labor and considers it advantageous to retain maintenance responsibility of installed ECMs.

C.7.3 When the implementation of an ECM changes existing equipment maintenance schedules, the Contractor shall prepare a new written maintenance work procedure for approval by the Government. The due date for the maintenance work procedure will be specified in the delivery order reporting requirements checklist. The Contractor shall train Government personnel in the new approved maintenance work procedure. The

Government will permit its personnel to attend training sessions at mutually agreed to times on the specific project site's premises.

C.7.4 If the Government assumes the proposed maintenance work in C.7.2.1 and/or C.7.2.3 above, the Government will maintain government-owned equipment, and contractor equipment in accordance with maintenance procedures provided by the Contractor and approved by the Agency Contracting Officer. Under the O & M section of the Contractor's Management Plan, the Contractor shall provide a description of how he plans to coordinate with, monitor, and verify implementation of the Contractor provided maintenance procedures by Government or contracted maintenance personnel.

C.7.5 The Government will not move, turn off, or otherwise change any contractor-owned equipment without the consent of the Contractor, unless such action is in accordance with the maintenance procedures provided by the Contractor, or if it is necessary in an emergency to prevent loss of life, injury or damage to property, or severe discomfort to Government personnel, visitors, occupants, or patients.

C.8 REPAIR OF ECMs

C.8.1 Repair of ECMs includes all material and equipment associated with the replacement or rebuilding of facilities, systems and equipment that have failed, or are determined by the Government to be in a condition of imminent failure and/or diminished ECM performance. Repair and replacement requirements are as follows:

1. Contractor Installed & Contractor-Owned Items. When contractor installed facilities, systems, and equipment fail, the Contractor shall be responsible for repairs (regardless of ownership). If equipment failure is a result of Government negligence or damage, the Government will provide repair or replacement within a reasonable time period, at its expense, or if repaired or replaced at Contractor expense, will reimburse the Contractor or adjust future invoice(s) as negotiated and agreed upon by the Government and the Contractor.
2. Contractor-Installed & Government-Owned Items. The contractor shall be responsible for the repair and replacement of any equipment that it both installs and derives annual payment from (regardless of ownership) during the term of the delivery order. This applies to contractor-purchased equipment whose title has been transferred to the Government, with a contractor security interest, and Government-furnished equipment that has been installed by the Contractor. If equipment failure is a result of Government negligence or damage, the Government will provide repair or replacement within a reasonable time period, at its expense, or if repaired or replaced at Contractor expense, will reimburse the Contractor, or adjust future invoice(s) as negotiated and agreed upon by the Government and the Contractor.

3. Existing Government-Owned Items. When existing Government-owned facilities, systems, and equipment fail, the Government will be responsible for repairs within a reasonable time period. The Contractor shall provide repairs, at no expense to the Government, if the Government-owned facilities, systems, and equipment failure is a result of actions on the part of the Contractor. The Contractor shall make repairs within a period of time as specified in the delivery order. If the Contractor elects to assume repair responsibilities for Government-owned systems or equipment as part of an ECM proposal, the delivery order shall include a listing of the types of repairs that will be the Contractor's responsibility.

C.9 CONTRACTOR MAINTENANCE AND REPAIR RESPONSE TIME

C.9.1 The Contractor shall establish a point of contact (name and phone number) for use by the Government in providing response to contractor equipment failures. The point of contact shall be available as specified in the delivery order throughout the delivery order's term. Initial telephone response to repair call messages shall be within the time frame specified in the delivery order. If a site visit is needed to repair equipment, repair personnel shall arrive on site within the time frame specified in the delivery order of the initial telephone response for non-emergency repairs or within the time frame specified within the delivery order for emergency repairs. Although normal contractor access is during the normal work hours specified for the specific site in the delivery order, the Contractor may be granted 24-hour per day access to the buildings for emergency work.

C.9.2 Emergency maintenance and repair work is defined as maintenance or repair necessary to correct an imminent failure of Section C.3 Standards of Service or any action necessary to protect the safety or health of the facility occupants and prevent adverse impacts on property.

C.9.3 In the event the Contractor fails to respond as required in the delivery order and in the event of emergencies, the Government may incur expenses to perform emergency repairs to contractor-installed equipment as well as Government equipment for which the Contractor assumed maintenance and repair responsibilities, and deduct such incurred expenses from future contractor invoices. The Contractor shall hold the Government harmless in such cases where the Contractor fails to respond in emergencies. In addition, the Contractor shall reimburse the Government for any costs incurred, as negotiated and agreed upon by the parties for specific projects.

C.10 OPERATIONS AND MAINTENANCE MANUALS AND TRAINING FOR ECMs

C.10.1 Operations and Maintenance Manuals

The Contractor shall furnish operation and maintenance (O&M) manuals and recommended spare parts lists for O&M of the contractor-installed ECMs and modified

Government equipment. O&M plans and spare parts lists shall be submitted prior to Government acceptance of the project, as specified in the delivery order.

C.10.2 Government Personnel Training for ECMs

1. Thirty (30) days prior to the installation completion, the Contractor shall train Government personnel and/or Government Operations and Maintenance (O&M) contractors as required to operate, maintain, and repair ECM equipment and systems in the event of emergencies.

a. Training Program - General Requirements: The Contractor shall provide a training program for Government personnel and/or Government O&M contractors for each ECM in a project. The program shall provide instruction on operation, troubleshooting, maintenance, and repair of ECMs. Training shall include both a classroom phase and a practical application phase. The course material shall include the operation and maintenance plans and manuals. The program shall be conducted at the delivery order's specified site(s) in facilities provided by the Government.

2. The Contractor shall train Government personnel and/or Government O&M contractors to operate, maintain, and repair ECM equipment ninety (90) days prior to the end of the delivery order's term.

C.11 GOVERNMENT PROJECTS

There shall be no restriction on Government projects of any kind including those that may provide energy conservation equipment, the removal of existing energy consuming equipment, or the addition of new energy consuming equipment for mission needs. The Government shall notify the Contractor when Government projects are to be implemented which may impact the installation or operations of contractor-installed ECMs. If the Government project affects determination of annual energy savings, then a baseline adjustment will be negotiated and incorporated into the delivery order by modification.

C.12 UTILITY ENERGY EFFICIENCY/RENEWABLE PROJECT FINANCIAL INCENTIVES

The implementation of an ECM may result in the Government being eligible for a financial incentive from the serving utility company or other entity charged with the administration of incentives by the state or territory. The Contractor shall be responsible for determining the availability of any applicable financial incentives, where the value of the incentives exceeds the incremental costs to obtain them. Further, the Contractor shall be responsible for coordinating with the Agency Contracting Officer or his/her designee as to the preparation of any and all documentation required to apply for any such

applicable financial incentives. When preparing any application for Government submission to the entity administering the incentives, the Contractor shall also submit a proposal to the Agency Contracting Officer or his/her designee, as specified in the delivery order, to address disposition of revenues acquired from the incentives administrator, which shall be negotiated with the Government.

C.13 AVAILABILITY OF UTILITIES

The Government will furnish water and electric current at existing outlets as may be required for the installation work to be performed under a delivery order at no cost to the Contractor. The Contractor at its expense and in a workmanlike manner satisfactory to the Agency Contracting Officer shall install and maintain all necessary temporary connections and distribution lines for each utility. Information concerning the location of existing outlets may be obtained from the Contracting Officer or the Contracting Officer's designated representative. The Contractor shall remove all the temporary connections, distribution lines, and associated equipment upon completion of the installation work.

C.14 GOVERNMENT FURNISHED PROPERTY AND CONTRACTOR FURNISHED MATERIAL

The Contractor shall provide all materials and supplies necessary to perform the work as specified in the delivery order. Materials and supplies provided shall be of acceptable industrial grade and quality and in compliance with any applicable standards (see Section C.5.2). All such materials and supplies must be compatible, and operate safely within design parameters of existing systems equipment.

As an ESPC contract presumes that all property will be furnished by the Contractor, a provision in a delivery order issued against this contract for specified Government Furnished Property for performance of this contract is not expected to normally occur. However, should Government Furnished Property be required or considered appropriate for a delivery order award, it would be designated and identified at this numbered provision in the delivery order request for proposal for the delivery order project.

C.15 CONTRACTOR EMPLOYEES

(a) Upon receipt of notice of award of a delivery order project under this contract, the Contractor shall provide the Agency Contracting Officer for the delivery order, or the Agency COR, with the name(s) of the responsible supervisory person(s) authorized to act for the Contractor.

(b) The Contractor shall furnish sufficient personnel to perform all work specified within the delivery order.

(c) Contractor employees shall conduct themselves in a proper, efficient, courteous, and businesslike manner.

(d) The Contractor shall remove from the site any individual whose continued employment is deemed by the Agency Contracting Officer or the Agency COR, acting reasonably, to be contrary to the public interest or inconsistent with the best interests of Government business or national security.

(e) No employee or representative of the Contractor will be admitted to the work site unless that employee furnishes satisfactory proof that he/she is a citizen of the United States or otherwise legally authorized to work in the United States.

C.16 FIRE PREVENTION

The Contractor shall ensure that its employees shall know how to activate a fire alarm. The Contractor shall observe all requirements for handling and storing combustible supplies, materials, waste and trash. Contractor employees operating critical equipment shall be trained to properly respond during a fire alarm or fire in accordance with the applicable agency's fire prevention procedures, rules or regulations as identified in the delivery order. The Contractor shall obtain all required welding permits prior to any welding.

C.17 SALVAGE

All material and equipment removed or disconnected during the implementation phase of a delivery order issued under this contract shall remain the property of the Government and shall be included in the proposal for each ECM. The Government will identify the equipment it wants stored. Any material and equipment not to be stored and all debris resulting from work under a delivery order shall be removed from the site by the Contractor at his expense.

C.18 ASBESTOS AND OTHER HAZARDOUS MATERIALS

As part of each ECM project proposed, it is preferred that the contractor include the cost of removal of any known hazardous-containing material in each contractor-proposed ECM that involves the removal of such. If the need for removal of hazardous material is known by the Contractor, but the cost is not included in the ECM project proposal, this need shall be identified by the contractor in the proposal.

Should the contractor propose and receive an award for an ECM project, and hazardous material is identified after award, the contractor shall immediately stop work, take measures to reduce the Contractor or building personnel contamination, and immediately

notify the Agency Contracting Officer and the building manager of the hazardous material condition and location. The Government shall then either:

- (a) remove and dispose of the material itself, by its own personnel or by separate contract award; or
- (b) give the contractor the option of either a delivery order modification for removing and disposing of the material at its expense, via a renegotiation of either the guaranteed savings and contractor payments for the project and/or of the delivery order project term, or by separate award for the effort. If the contractor performs the effort, he shall be required to remove the hazardous material in the manner agreed upon by the parties, and any equitable adjustment necessary due to the change to or elimination of the ECM involved shall be handled as a delivery order modification.

In addition, hazardous material and PCB handling and disposal, if it is or becomes the responsibility of the Contractor in a delivery order award, shall be handled as follows:

- (a) **Hazardous Material Handling and Disposal:** Hazardous wastes resulting from contractor-owned material and equipment must be disposed of in accordance with Resource Conservation and Recovery Act and all applicable Federal, state and local regulations. All shipping manifests for hazardous waste must be signed by the authorized Federal personnel for the project site, as well as by the Contractor prior to transfer off-site. The Federal agency's generator number will be entered on the manifest. The delivery order will provide additional site specific requirements.
- (b) **PCB Handling and Disposal:** If PCB ballasts exist at a site covered by a delivery order, then the delivery order shall contain the necessary clause addressing PCB recycling and/or disposal requirements to comply with applicable state and local regulations. The delivery order will provide additional site specific PCB handling and disposal requirements (if applicable).

Specific delivery orders will specify the requirements if different than the above, and/or as known at time of award.

C.19 DISPOSAL

Non-hazardous debris, rubbish and nonusable material resulting from the work shall be removed from Government property by the contractor at its expense.

C.20 SAFETY REQUIREMENTS

All work shall be conducted in a safe manner and shall comply with the requirements in the Army Corps of Engineers Safety manual and the Accident Prevention clause in Section I of this contract (FAR 52.236-13). The Government will not provide safety

equipment to the Contractor. Additional safety requirements may be included in delivery orders based on individual Federal agency implementing regulations, and/or specific requirements of the delivery order projects.

Other specific requirements relative to safety are as follows:

- (a) Prior to commencing work, the Contractor shall meet with the Agency Contracting Officer and the Agency COR to agree upon administration of the safety program.
- (b) The contractor's workplace may be inspected periodically for OSHA violations. Abatement of violations shall be the responsibility of the Contractor and/or the Government as determined by the Agency Contracting Officer. The Contractor shall provide assistance to the Government representative and Federal or state OSHA inspector if a complaint is filed. Any fines levied on the Contractor by Federal or state OSHA offices due to safety/health violations will be paid promptly by the contractor.
- (c) In accordance with the Accident Prevention clause in Section I of this contract, the contractor shall report to the Agency Contracting Officer or COR all accidents within 24 hours of their occurrence.
- (d) In accordance with the Accident Prevention clause in Section I of this contract, the contractor shall submit to the Agency Contracting Officer or Agency COR a full report of damage to Government property and equipment by contractor's employees or contractor's subcontractors, at any tier. All damage reports shall be submitted to the Agency Contracting Officer or COR within 24 hours of their occurrence.
- (e) A safety and health plan and hazard analysis shall be prepared prior to the start of work on a construction site.

C.21 SECURITY REQUIREMENTS

- (a) **Passes and Badges:** All contractor employees shall obtain employee and vehicle passes and badges as required by the agency for the specific delivery order project site. The Contractor shall, prior to the start of on-site work, submit to the Agency Contracting Officer, or the Agency Contracting Officer's designated representative, an estimate of the number of employees expected to be utilized at any one time on the delivery order. The Government will issue badges it requires without charge. When an employee leaves the contractor's service, the employee's pass and badge shall be returned within ten (10) days.
- (b) **Contractor Vehicles:** Each contractor vehicle shall display the contractor's name such that it is clearly visible. Contractor vehicles shall, at all times, display a valid state license plate and safety inspection sticker. The Government may issue vehicle passes as it determines, and these shall also be displayed so as to be clearly visible.

(c) Contractor Access to Buildings:

1. It shall be the contractor's responsibility, through the Agency Contracting Officer or the Agency COR's designated representative, to obtain access to buildings on the delivery order project site, as necessary, and arrange for the buildings to be opened and closed as follows:

i. For minor work of two hours or less duration, the contractor shall contact the building manager and security organization.

ii. For major work, defined as work in excess of two hours duration, and/or work that will create dust or noise, the contractor shall contact the Agency Contracting Officer or the Agency Contracting Officer's designated representative at least one week in advance of the start of the work. The contractor must provide a description of the work, the number of workers required, and duration of the work.

2. Keys may be issued to the contractor; however, it shall be the contractor's responsibility to make adequate arrangements for security of the building at the end of each work day. The contractor shall be responsible for the cost of replacing any keys that are furnished to and lost by its employees. If the Agency Contracting Officer or the Agency COR decides that a lock must be replaced because of the loss of a key by the contractor's employee(s), the contractor shall pay the cost of that replacement. Similarly, the contractor shall pay the cost of changing a combination if the Agency Contracting Officer or the Agency COR has reasonable cause to assume that the combination has been compromised.

3. Access to tenant spaces must be scheduled with the Agency Contracting Officer or the Agency Contracting Officer's designated representative at least ten (10) days in advance, unless otherwise indicated in the delivery order. Notice must include names of employees to be admitted, expected arrival time, and visit duration. Buildings that require an escort will be identified in the solicitation for a specific project. All access will be during normal working hours, Monday through Friday, as specified in the delivery order.

(d) Contractor Access to secure areas: Certain areas of a project site may require that the contractor and its employees have an escort, and/or place limits on the days and times that the contractor and its employees may work in these areas. Specific delivery orders will identify any such secure areas and the requirements for contractor access to them.

C.22 PERMITS

In accordance with the "Permits and Responsibilities" clause in Section I, the contractor shall, without additional expense to the Government, obtain all appointments, licenses, and permits required to conduct the work. The contractor shall comply with all

applicable Federal, state and local laws. Evidence of such permits and licenses shall be provided to the Agency Contracting Officer or the Agency COR before work commences.

C.23 WORK SCHEDULE REQUIREMENTS

The contractor shall arrange its on-site work so that it will not interfere with normal Government business. The contractor shall develop a monthly work schedule for all on-site work performed from delivery order award through implementation and performance periods for all ECMs. In no event shall the contractor change approved work schedules without the prior consent of the Agency Contracting Officer or the Agency Contracting Officer's designated representative.

If the contractor desires to work on Saturday, Sunday, holidays, or outside the project site's normal working hours, which normal working hours will be specified in the delivery order, it may submit a request for approval to the Agency COR at least seven (7) working days

SECTION H C SPECIAL CONTRACT REQUIREMENTS

H.1 CONFIDENTIALITY OF INFORMATION (APR 1984)

(a) To the extent that the work under this contract requires that the contractor be given access to confidential or proprietary business, technical, or financial information belonging to the Government or other companies, the contractor shall, after receipt thereof, treat such information as confidential and agree not to appropriate such information to its own use or to disclose such information to third parties unless specifically authorized by the Contracting Officer in writing. The foregoing obligations, however, shall not apply to:

1. Information which, at the time of receipt by the contractor, is in the public domain;
2. Information which is published after receipt thereof by the contractor or otherwise becomes part of the public domain through no fault of the contractor;
3. Information which the contractor can demonstrate was in his possession at the time of receipt thereof and was not acquired directly or indirectly from the Government or other companies;
4. Information which the contractor can demonstrate was received by it from a third party who did not require the contractor to hold it in confidence.

(b) The contractor shall obtain the written agreement, in a form satisfactory to the Contracting Officer, of each employee permitted access, whereby the employee agrees that he will not discuss, divulge or disclose any such information or data to any person or

entity except those persons within the contractor's organization directly concerned with the performance of the contract.

(c) The contractor agrees, if requested by the Government, to sign an agreement identical, in all material aspects, to the provisions of this clause, with each company supplying information to the contractor under this contract, and to supply a copy of such agreement to the Contracting Officer. From time to time upon request of the Contracting Officer, the contractor shall supply the Government with reports itemizing information received as confidential or proprietary and setting forth the company or companies from which the contractor received such information.

(d) The contractor agrees that upon request by DOE it will execute a DOE-approved agreement with any party whose facilities or proprietary data it is given access to or is furnished, restricting use and disclosure of the data or the information obtained from the facilities. Upon request by DOE, such an agreement shall also be signed by contractor personnel.

(e) This clause shall flow down to all subcontracts.

H.2 REPRESENTATIONS, CERTIFICATIONS AND OTHER STATEMENTS OF THE OFFEROR

The Representations, Certifications and Other Statements of the contractor for this contract, dated January 16, 2003 are incorporated by reference. They are located in the official contract file for the award.

Additional representations and certifications may be required by the Agency Contracting Officer for specific delivery order awards.

H.3 TECHNICAL DIRECTION (JAN 1990)

(a) Performance of the work under this contract shall be subject to the technical direction of the Contracting Officer's Representative (COR) identified in Section G.1 (a) of this contract, or of the Agency COR for a specific delivery order issued against this contract. "COR" and "Contracting Officer" throughout this provision refer to either the DOE or Agency personnel, as applicable, and/or indicated. The term "technical direction" is defined to include:

1. Directions to the contractor which redirect the contract effort, shift work emphasis between work areas or tasks, require pursuit of certain lines of inquiry, fill in details or otherwise serve to accomplish the contractual Statement of Work.
2. Provision of written information to the contractor which assists in the interpretation of drawings, specifications or technical portions of the work description.

3. Review and, where required by the contract, approval of technical reports, drawings, specifications and technical information to be delivered by the contractor to the Government under the contract.

(b) Technical direction must be within the scope of work stated in the contract. The COR does not have the authority to, and may not, issue any technical direction which:

1. Constitutes an assignment of additional work outside the Statement of Work;
2. Constitutes a change as defined in the contract clause entitled "Changes";
3. Causes an increase or decrease in the total price or the time required for contract performance;
4. Changes any of the expressed terms, conditions or specifications of the contract;
or
5. Interferes with the contractor's right to perform the terms and conditions of the contract.

(c) All technical direction shall be issued in writing by the COR.

(d) The contractor shall proceed promptly with the performance of technical direction duly issued by the COR in the manner prescribed by this article and within his authority under the provisions of this clause. If, in the opinion of the contractor, any instruction or direction by the COR falls within one of the categories defined in (b)(1) through (5) above, the contractor shall not proceed but shall notify the Contracting Officer in writing within five (5) working days after receipt of any such instruction or direction and shall request the Contracting Officer to modify the contract accordingly. Upon receiving the notification from the contractor, the Contracting Officer shall:

1. Advise the contractor in writing within thirty (30) days after receipt of the contractor's letter that the technical direction is within the scope of the contract effort and does not constitute a change under the "Changes" clause of the contract;
2. Advise the contractor within a reasonable time that the Government will issue a written change order.

(e) A failure of the contractor and Contracting Officer to agree that the technical direction is within the scope of the contract, or a failure to agree upon the contract action to be taken with respect thereto shall be subject to the provisions of the clause entitled "Disputes Alternate I" of the contract.

H.4 MODIFICATION AUTHORITY (APR 1984)

Notwithstanding any of the other provisions of this contract, the Contracting Officer shall be the only individual authorized to:

- (a) accept nonconforming work;
- (b) waive any requirement of this contract, or
- (c) modify any term or condition of this contract.

H.5 GOVERNMENT PROPERTY AND DATA (MODIFIED) (JAN 1992)

(a) Except as otherwise authorized by the Contracting Officer in writing, the Contractor is not authorized to acquire as a direct charge item under this contract any real or personal property items. The Agency Contracting Officer for a specific delivery order issued against this contract may authorize the acquisition of government property or data, as agreed upon and indicated in the specific delivery order.

H.6 GOVERNMENT PROPERTY REGULATIONS

The contractor and its employees shall be knowledgeable of and observe all Government property regulations, posted or otherwise, at the site where performance occurs for specific delivery order projects. A copy of the applicable agency regulations for the specific project site will be provided by the Agency COR for the project, upon contractor request.

H.7 RESPONSIBILITY FOR LOSS OR DAMAGE TO CONTRACTOR PROPERTY

The Government shall be responsible for loss or damage to the property of the contractor and its employees only to the extent authorized by the Federal Tort Claims Act.

H.8 SUBCONTRACTS (MODIFIED) (SEP 1996)

(a) Prior to the placement of subcontracts and in accordance with the clause, "Subcontracts-Fixed-Price Contracts," the Contractor shall ensure that:

1. they contain all of the clauses of this contract (altered when necessary for proper identification of the contracting parties) which contain a requirement for such inclusion in applicable subcontracts. Particular attention should be directed to the potential flowdown applicability of the clauses entitled "Utilization of Small Business Concerns" and "Small Business Subcontracting Plan" contained in Part II, Section I of the contract;
2. any applicable subcontractor Representations and Certifications are obtained; and

3. any required prior notice and description of the subcontract is given to the Agency Contracting Officer and any required consent is received. Except as may be expressly set forth therein, any consent by the Agency Contracting Officer to the placement of subcontracts shall not be construed to constitute approval of the subcontractor or any subcontract terms and conditions, determination of any price revision of the delivery order issued against this contract or any of the respective obligations of the parties thereunder, or creation of any subcontractor privity of contract with the Government.

(b) The contractor shall also obtain and furnish to the Agency Contracting Officer either an OCI Disclosure Statement or Representation form in accordance with DEAR 952.209-72 "Organizational Conflicts of Interest Disclosure or Representation" for all subcontractors to be utilized under this contract at DOE project sites. No work shall be performed by the subcontractor until the Agency Contracting Officer has cleared the subcontractor for Organizational Conflicts of Interest (OCI).

H.9 ADDITIONAL DELIVERY ORDER CLAUSES FOR WORK ON DOE FACILITIES HAVING CLASSIFIED INFORMATION

(a) If the ECM project covered by a delivery order involves work to be performed at a Department of Energy facility that has classified information (section 41 of the Atomic Energy Act of 1954, as amended), DEAR 952.204-2 Security (SEP 1997) and DEAR 952.204-70 Classification /Declassification (SEP 1997) may apply to that delivery order. The specific delivery order for such site shall incorporate these clauses, if applicable.

If the ECM project covered by a delivery order involves work to be performed at a Department of Energy facility that has classified information (section 41 of the Atomic Energy Act of 1954, as amended), the contractor may be required to submit representation concerning DEAR 952.204-73 Foreign Ownership, Control or Influence over Contractor (JUL 1997), and the clause DEAR 942.20-74 Foreign Ownership, Control or Influence over Contractor (Apr 1984) may apply to that delivery order. The solicitation for such site would request the representation, and the specific delivery order for such site would incorporate the clause, if applicable.

H.10 USE OF NON-FEDERAL PERSONNEL IN EVALUATIONS

The Government requires non-government personnel from Federally-Funded Research and Development Centers (FFRDCs) and their subcontractors as advisors in proposal evaluation and as project facilitators for delivery order projects because aspects of the technical proposal evaluations and project facilitation require specialized training, experience and skills available from the FFRDCs that are not available in the Department of Energy.

H.11 FLOWDOWN OF SAFETY AND HEALTH CLAUSE (JAN 1993)

The clauses at DEAR 952.223-71 and DEAR 970.5223-1 appropriately adjusted to reflect the contractor/subcontractor relationship, shall be included in subcontracts awarded under this contract if the subcontractor will be performing work under the subcontract at a government-owned or leased facility where DOE has required the contractor to submit a management program and implementation plan (MPIP) in accordance with DEAR 970.5204-2. However, DOE reserves the right to require the contractor to submit subcontractor MPIP's to the Agency Contracting Officer for review prior to approval by the contractor and prior to the start of work.

H.12 QUALITY ASSURANCE SYSTEM (DEC 1995)

In the conduct of the work performed under this contract, the contractor agrees to establish and/or maintain the quality assurance system described in the delivery order issued against this contract. If the Contractor has responsibility to perform activities in connection with a nuclear facility, as defined by Title 10, Section 830.3, Code of Federal Regulations, the applicability of the requirements in Section 830.120 shall be determined. Any subcontracts in support of this work shall require subcontractors to comply with the Contractor's quality assurance system.

H.13 WAGE DETERMINATIONS AND DAVIS BACON WAGE RATES

In the performance of delivery order projects issued against this contract, the contractor shall comply with the requirements of any applicable U.S. Department of Labor Wage Determination(s) and Wage Rates which may be issued, or are otherwise applicable relative to that project. A copy of the Wage Determination(s) and/or Wage Rates shall be attached to the delivery order award, in accordance with agency format requirements, or otherwise provided or referenced.

H.14 LIQUIDATED DAMAGES

Since this IDIQ contract is for use by all authorized Federal agencies in a specific region, and the specific ECM projects are not known at this time, the Government cannot make a determination as to whether Liquidated Damages would apply to any individual delivery order. Therefore, a specific solicitation and award for a delivery order project may include appropriate liquidated damages provisions, per Federal agency requirements and/or preferences.

H.15 TITLE TO AND RESPONSIBILITY FOR CONTRACTOR-INSTALLED EQUIPMENT

(a) All equipment installed by the contractor at an installation is and remains the property of the contractor during the delivery order's term, unless otherwise specified and mutually agreed to in a delivery order. A change in the delivery order from this contract default is acceptable where it will decrease the cost and/or improve the financing of a delivery order project, or as otherwise determined in the best interests of the agency. Appropriate language to protect the parties will be negotiated by the Agency Contracting Officer and contractor for inclusion in a delivery order award, where title to installed equipment is taken by the Government after acceptance of installation/conclusion of the implementation phase of the delivery order term, and prior to the performance period of the delivery order term.

(b) The contractor may modify, replace, or change the systems and equipment during the delivery order from that originally approved. However, any proposed modification, replacement, or change shall require notification and coordination with and approval of the Agency Contracting Officer. Any such modification, replacement, or change of systems or equipment shall be performed by the contractor at no cost to the Government and shall not interfere with Government operations and mission.

(c) At the expiration of the delivery order term, all rights, title (unless already vested in the Government), and interest in and to all improvements and equipment constructed or installed on the premises and additions, shall vest in the Government, at no additional cost, free and clear of all and any mechanics liens and encumbrances created or caused by the contractor, or of any security interest by the contractor or its financier(s). The contractor shall surrender possession of said premises and the improvements and equipment to the Government in good repair and condition, reasonable wear and tear accepted.

(d) If specific IDIQ contract delivery orders or certain ECMs within a delivery order are terminated for convenience, all rights, title, and interest in and to all improvements, additions, or equipment of all ECMs installed by the contractor to which the Government determines to take possession shall vest in the Government. For those ECMs for which the Government takes possession and thereby obtains title (if not already vested), the contractor shall be compensated in accordance with the FAR clause Termination for Convenience (52.249-2).

H.16 REQUIRED INSURANCE

(a) The contractor shall procure at its expense and maintain during the entire period of performance under this IDIQ contract and the delivery orders awarded to the contractor against it, the following minimum insurance coverage:

1. Comprehensive general liability: \$500,000 per occurrence.
2. Automobile liability: \$200,000 per person, \$500,000 per occurrence, \$20,000 per occurrence for property damage.

3. Workman's compensation: As required by Federal and state workers' compensation and occupational disease statutes.
4. Employer's liability coverage: \$100,000 except in states where workers' compensation may not be written by private carriers.
5. Other insurance as required by State law.

(b) Specific delivery orders may require less, additional, or different insurance coverage, which will be specified in the delivery order. If different insurance coverage is specified as required for a specific delivery order project, the contractor shall maintain at its own expense for the delivery order term, the revised insurance coverage, in accordance with the following:

1. Prior to commencement of work, the contractor shall furnish to the Agency Contracting Officer a certificate or written statement of the required insurance coverage. The policies evidencing required insurance coverage shall contain an endorsement to the effect that cancellation or any material change in the policies adversely affecting the interests of the Government in such insurance shall not be effective for such period as may be prescribed by the laws of the State in which the delivery order is to be performed and in no event less than thirty (30) days after written notice thereof to the Agency Contracting Officer.
2. The contractor agrees to insert the substance of this clause in all subcontracts hereunder.
3. Nothing herein shall relieve or limit the contractor of liability for losses and damages to person or property as a result of its operations. The contractor shall indemnify and hold harmless the Government from any and all liability associated with the contractor's operations.

H.17 NOTICE OF PAYMENT AND PERFORMANCE BOND REQUIREMENTS

Bonds, using Standard bond forms, SF-25 and SF-25A, or other agency-required documentation, may be required for a delivery order project. If they are required, they shall be provided in accordance with the following provisions (unless altered by the delivery order requirements). These forms, if not otherwise available to the contractor, may be obtained from the Agency Contracting Officer.

H.17.1 Project Financing by Contractor

1. The Government will notify the selected contractor of its intent to award the delivery order. Pursuant to Section H.26, Preaward Requirements, the selected contractor shall furnish acceptable evidence of a surety's commitment to provide performance and payment bonds to the Government.

2. Within 30 days after award of delivery order or acceptance of the Design and Construction Package, whichever is later, the selected contractor shall provide a performance bond (Standard Form 25 or other) and a payment bond (Standard Form 25A or other) in duplicate. The performance bond shall be in a penal sum equal to 100 percent of the Bonded Amount for all ECMs cited in Schedule DO-2. The payment bond shall be in a penal sum as follows:

From Schedule DO-2	Payment Bond Penal Sum
\$0 - \$999,999	50% of Schedule DO-2 Bonded Amount
\$1 - \$4.99 million	40% of Schedule DO-2 Bonded Amount
>\$5 million	\$2.5 million

The performance and payment bonds shall remain in effect during the total implementation period for all ECMs. The ECM implementation period shall include all time required for installation, testing, measuring initial performance, and Government acceptance of all installed ECMs. The performance bond shall be released upon Government acceptance of all contractor-installed ECMs. The payment bond shall be released upon receipt of satisfactory evidence that all subcontractors, laborers, and other subcontractors have been paid in full.

3. Because ECMs are installed on or affixed to Government property, mechanics liens are prohibited. Therefore, the payment bond shall secure the contractor's obligations for payment of laborers, suppliers, and all subcontractors. Each subcontract, under this IDIQ contract or under a specific delivery order, shall include a provision that prohibits placing mechanics liens against any ECMs installed on or affixed to Government property.

H.17.2 Project Financing by Third Party

1. The Government will notify the selected contractor of its intent to award the delivery order. Pursuant to Section H.26, Preaward Requirements, the selected contractor shall provide, to the Government, proof of project financing and acceptable evidence of a surety's commitment to provide performance and payment bonds.

2. Within 30 days of award of the delivery order or acceptance of the Design and Construction Package, whichever is later, the selected contractor shall furnish a certified copy and duplicate of a performance bond, with project financier as co-beneficiary along with the Government. The performance bond shall be in a penal sum equal to 100 percent of the total Bonded Amount for all ECMs cited in Schedule DO-2. The selected contractor shall furnish a payment bond (Standard Form 25A) in duplicate. The payment bond shall be in a penal sum equal as follows:

From Schedule DO-2 Payment Bond Penal Sum

\$0 - \$999,999	50% of Schedule DO-2 Bonded Amount
\$1 - \$5 million	40% of Schedule DO-2 Bonded Amount

>\$5 million

\$2.5 million

The performance and payment bonds shall remain in effect during the total implementation period for all ECMs. The ECM implementation period shall include all time required for installation, testing, measuring initial performance, and Government acceptance of all installed ECMs. The performance bond shall be released upon Government acceptance of all contractor-installed ECMs. The payment bond shall be released upon receipt of satisfactory evidence that all subcontractors, laborers, etc., have been paid in full.

3. Because ECMs are installed on or affixed to Government property, mechanics liens are prohibited. Therefore, the payment bond shall secure the contractor's obligations for payment of laborers, suppliers, and all subcontractors. Each subcontract, under this IDIQ contract or under a specific delivery order, shall include a provision that prohibits placing mechanics liens against any ECMs installed on or affixed to Government property.

H.18 PROTECTION OF FINANCIER'S INTEREST

(a) The Government recognizes that project financing associated with contractor performance on the multi-year delivery orders issued against this contract may be accomplished using third-party financing, and as such, will permit the financing source to perfect a security interest in the installed energy conservation measures, subject to and subordinate to the rights of the Government. To provide protection of any financier's interest, the contractor may be required to assign to its lenders, some or all of its rights under a delivery order. The Government will consider:

1. Requests for assignments of monies due or to become due under a delivery order, provided the assignment complies with the Assignment of Claims Act.
2. Requests for the Government to provide lenders or financiers copies of any cure or show-cause notice issued to the contractor.
3. Requests by lenders or lienholders for extension of response time to cure or show-cause notices.
4. A proposed takeover of delivery order performance in the event the contractor defaults in performance, or is bought by another company, or otherwise is replaced by mutual agreement of the parties. Requests for takeover of the delivery order on substantially the same terms and conditions will be approved, if the proposed substitute party is acceptable to the Government and such takeover is in the Government's best interests.

The Government review and approval of the above requests will not be unreasonably withheld or delayed. In addition, the Government will ensure that all requirements to establish cancellation ceilings and to make Congressional notifications will be satisfied.

H.19 ADDITIONAL OR DIFFERENT CLAUSES AND PROVISIONS FOR DELIVERY ORDERS AND DELIVERY ORDER REQUEST FOR PROPOSAL (DO RFP) FORMAT

As previously indicated, this IDIQ contract may be used by all Federal agencies. Therefore, and in accordance with Section C.1, the solicitation for a specific delivery order (the DO RFP; see below) may contain additional clauses and provisions, as well as differing clauses and provisions than those included in this contract, whether due to FAR, other agency-specific regulations, or agency requirements or practices dictated by the specific project. The agency-specific requirements as documented in the agency solicitation (DO RFP) shall be understood to either override or supplement the contract requirements, as indicated in the DO RFP, and as permitted by the language at Section C.1 of this contract.

The DOE Contracting Officer for this IDIQ contract has created a prescriptive Delivery Order Request for Proposal (DO RFP) format for use by ordering agencies in requesting offers from the IDIQ contractor(s) for specific delivery order projects issued against this contract, and will make it available upon request to any authorized Contracting Officer from any Federal agency. This format provides, in IDIQ contract chronological order, those provisions and clauses throughout the contract which may need to be revised/deleted/replaced in developing the description of a specific project, thereby providing the differing or additional agency and site specific requirements relative to it. Ordering agencies will be encouraged to use this format in requesting offers for specific projects to be ordered against this contract. The purposes for the use of the standard DO RFP format are: (1) to facilitate rapid processing of delivery order project awards; (2) to minimize the contract administration required for the IDIQ contracts and especially the delivery orders; and (3) to promote consistency among the agencies ordering against the IDIQ contracts, for the benefit of the IDIQ contractors.

H.20 PROCEDURES FOR AWARDING DELIVERY ORDERS

The Government has awarded more than one contract for the work specified in the Statement of Work for this contract. The Agency Contracting Officer or other authorized ordering official may issue delivery orders to the contractor and/or other contractors during the terms of the respective contracts. Selection of the contractor for issuance of a specific delivery order will be made pursuant to the provisions in either paragraph (a) or (b) below.

The Agency Contracting Officer for a specific delivery order project, in consultation with the DOE Contracting Officer, shall have the final decision authority as to the extent to which offers will be solicited for individual delivery orders, taking into account technical, economic and performance risk considerations; past performance on previous delivery orders issued against the IDIQ contract; and the factors described below. Such decisions shall not be subject to protest.

No protest under 48 CFR (FAR) Part 33 is authorized in connection with the issuance or proposed issuance of a delivery order under this contract except for a protest on grounds that the delivery order increases the scope, term or maximum value of the contract. The DOE Task and Delivery Order Ombudsman shall be ultimately responsible for reviewing complaints from any contractor arising from the Agency Contracting Officer decision as to the extent to which offers will be solicited for individual delivery orders, and for ensuring in general that all of the contractors receiving awards are afforded a fair opportunity to be considered.

The contractor agrees that issuance of a delivery order in accordance with any of the procedures in this provision is deemed to have provided the contractor with a "fair opportunity to be considered," as that phrase is used in Section 303J(b) of the Federal Property and Administrative Services Act of 1949, as amended.

(a) Single Source Awards

The Agency Contracting Officer may issue a delivery order to any one of the contractors with a SUPER ESPC award for this DOE region if an Agency Contracting Officer has determined unilaterally that:

1. The agency's need for the services ordered is of such unusual urgency that providing such opportunity to all contractors would result in unacceptable delays in fulfilling that need;
2. Only one such contractor is capable of providing the services or property required at the level of quality required because the services or property ordered are unique or highly specialized;
3. It is a Contractor-Identified project for which rationale can be identified and documented that consideration of other IDIQ contractor offers for the project site is not in the best interests of the Government;
4. It is necessary to place an order with a particular contractor in order to satisfy a minimum guarantee of this contract; and

5. The delivery order should be issued on a sole source basis in the interest of economy and efficiency because it is a logical follow-on to a delivery order previously issued to a contractor on a competitive basis.

(b) Awards Based on Competition among Eligible IDIQ Contractors:

1. The Agency Contracting Officer may make selections of IDIQ contractors and issue delivery orders based on competition among two or more of the awardees for these ESPC efforts, i.e., a Government-Identified selection process. Evaluation of performance against previous delivery orders against this contract may be used as a means of selecting a limited number of contractors (i.e., less than the total number of IDIQ contractors receiving an award for the Statement of Work for this contract) that may submit proposals.

The Government anticipates awarding fixed price delivery orders against this contract.

Projects will, therefore, be pursued as either a Contractor-Identified Delivery Order Project or a Government-Identified Delivery Order Project. A Contractor-Identified Delivery Order Project is an ESPC project identified/developed by one of the multiple awardee IDIQ contractors and accepted by their applicable DOE Regional COR and an agency client. A Government-Identified Delivery Order Project is an ESPC project initiated by a Federal agency's release of a DO RFP and associated technical package to multiple awardee IDIQ contractor(s).

Unless modified in the DO RFP for a Contractor-Identified project, the delivery order process for both types of projects are usually in two steps, requiring the IDIQ contractor to submit an Initial Proposal (for the agency to make its conditional selection of the contractor) followed by submission of a Detailed Energy Survey and Final Proposal. Initial proposal preparation instructions are described at Section H.21, and its evaluation procedures are described in Section H.22. The Detailed Energy Survey requirements are provided in Section H.23. The final proposal preparation instructions are specified in Section H.24 and its evaluation procedures are specified in Section H.25. Ordering agencies may identify different instructions and procedures than those included in these contract sections in the DO RFPs for their specific delivery order projects; however, the instructions and procedures provided below will apply unless other instructions which supersede or revise them are identified in the DO RFPs.

Before an IDIQ contractor may submit a Contractor-Identified Proposal, the IDIQ contractor must first obtain the concurrence of the DOE COR for this contract. This request for concurrence should be in writing and the request should provide sufficient information such that the DOE COR is able to discuss the request with the agency where the project is proposed to be performed. The DOE COR will provide the requested concurrence, or nonconcurrence, in writing, and within fifteen (15) days of the request. Upon this concurrence, an initial proposal within the scope of this contract may be submitted.

H.21 REQUIREMENTS FOR INITIAL PROPOSAL CONTENTS FOR DELIVERY ORDER ECM PROJECTS

The purpose of the Initial Proposal is to provide the minimum information required for the Government (specifically, the agency personnel where the potential project would be performed and the DOE COR) to review the merits of the project and its potential technical feasibility, and thereby make a determination as to whether the potential project will be pursued. After review of the Initial Proposal submitted, the Agency Contracting Officer will respond to the IDIQ contractor in writing indicating whether or not the project will be pursued and by what means. This Notice of Intent to Award (NOI) and the associated DO RFP will detail any other specific requirements. The NOI will normally be issued concurrently with the DO RFP for the project, although concurrent issuances are not required. Note that the NOI and DO RFP may permit or require additional, different or deleted ECMs, with associated scope changes, in the final proposal, or otherwise establish parameters for the final proposal which cause variance from the Initial Proposal.

The Government shall not be liable for costs associated with audits and preparation of Initial Proposals, unless the project addressed by the Initial Proposal later becomes a delivery order award. Further, the Government will not have the rights to the contractor's proprietary work products, such as surveys, data, feasibility study reports, and design documentation.

The Contractor shall submit a technical and price proposal in both electronic (Word and Excel) and hardcopy formats. The technical and price proposal shall be in accordance with the following requirements, i.e., contain at least the following minimum information:

Identification of ECM Project: Identify the location of the ECM project (e.g., the Federal Agency, the facility manager's name and telephone number, the building and site address, etc.), and provide a narrative summary of the proposed ECM project to include, at a minimum: (a) proposed system or component upgrade, deficiency correction, repair or replacement; and (b) proposed system operational changes and estimated energy usage before and after implementation of the proposed ECMs.

(b) **Energy Savings Proposed:** This section shall describe the estimated annual energy savings for the ECM project using Schedule DO-4 (in all applicable energy/demand units). While a detailed energy analysis is not expected at this time, the contractor should submit its (a) assumptions on current facility or energy system operating conditions, (b) assumptions on proposed facility or energy system operating conditions, (c) energy savings calculations using formulae and procedures based on accepted engineering principles, including synergistic effects of other ECMs, and (d) references used for data, assumptions or empirical formulas. This section should contain only sufficient information for the Government to determine whether it is a feasible project.

(c) M&V Overview: Provide a general description of and support the measurement and verification plan proposed for this project, referenced to the FEMP M&V Guide.

(d) Management Approach: Provide the following:

1. Organization: Show the organization (by name as available) for implementing and managing the project, to include the responsibilities of each individual/element shown and the lines of authority within the overall organization. Also identify what portions of the effort, if any, are to be subcontracted, and if so, provide the same information for subcontractor organization and personnel.

2. Risk/Responsibility Matrix: The contractor shall complete and submit with its Initial Proposal a Risk/Responsibility Matrix detailing its proposed approach or method to address each area in the Risk/Responsibility Matrix. The format and content of this Risk/Responsibility Matrix is provided at Part III, Section J, Attachment 5. The agency will review and provide comments on its assessment of the proposed contractor and agency roles and responsibilities based on this required contractor submittal.

3. Operations, Maintenance, Repair and Replacement: Show the organization structure and describe the approach for performance of the delivery order's operations, maintenance and repair and replacement requirements.

(e) Price Proposal: The contractor shall submit completed Schedules DO-1 (Initial), DO-2, DO-3 and DO-4. For a contractor-identified ECM project, Rough Order of Magnitude Estimates are acceptable. For a Government-identified project, the DO RFP may require more detailed estimates. The pricing in these schedules should be supported with the minimum amount of detail to permit the Government to determine whether it is a cost-effective project.

Explanations of the schedules and instructions for their completion are provided below:

Schedule DO-1 (Initial) C Proposed Guaranteed Annual Cost Savings and Annual Contractor Payments:

Schedule DO-1 (Initial) is used to submit the offeror's proposed estimated annual cost savings, and annual contractor payments for a specific delivery order ECM project, and shall be submitted with all delivery order proposals. The values submitted on Schedule DO-1 (Initial) are for 12-month periods, beginning after completion by the contractor of the implementation period for all ECMs, and acceptance by the Government. The estimated annual cost savings proposed for each year of the proposed delivery order performance period shall be based on projected energy savings presented in the technical proposal for the delivery order project, and trace to the other DO Schedules required for submission. The annual contractor payments proposed shall be for each year of the

proposed delivery order performance period after ECM implementation and acceptance by the Government.

Each DO RFP shall specify the rates and any applicable escalation that will be used for utilities during the delivery order's period of performance. The estimated annual cost savings in column (a) of Schedule DO-I (Initial) shall be based on the specified rates for utilities and any applicable escalation. If specified rates are not used, then the DO RFP must indicate how the contractor is to propose.

Schedule DO-2C Implementation Price for ECMs:

Schedule DO-2 shall be submitted for all delivery order project proposals with estimated pricing, and the schedule may be revised and resubmitted by the selected contractor upon completion of their Detailed Energy Survey and submission of a final proposal. Schedule DO-2 presents the offeror's implementation period investment for each ECM included in a specific delivery order project. It reflects the equipment proposed for installation for each ECM indicated along with its implementation price, the contract mark-up (up to the maximum proposed in Schedule B-1) applied to this pricing, the subtotals of investment for each discrete ECM, and then the calculation of the total estimated implementation price, or investment for all proposed ECMs for the delivery order project. This information is requested as a trace to the information provided in Schedule DO-3.

The total bonded amount on DO-2 will be used to establish performance and payment bond requirements for the ECM implementation period, if applicable, in accordance with Section H-17.

Schedule DO-3 C Performance Period Cash Flow

Schedule DO-3 shall be submitted for all delivery order project proposals with estimated pricing, and the schedule may be revised and resubmitted by the selected contractor upon completion of their Detailed Energy Survey and submission of a final proposal. Schedule DO-3 presents the offeror's proposed project cash flow for a specific delivery order project. The schedule is divided into two sections. The Implementation Period section pertains to the implementation price (which should trace back to the Schedule DO-2 price) less any pre-performance period payments, plus the debt service stream on that investment. The Performance Period section pertains to the total expenses associated with the services the contractor supplies to manage the project, and maintain and verify ECM performance during the performance period of the delivery order term. The offeror shall propose the estimated delivery order cash flows for each year of the proposed delivery order term. The pricing provided in this schedule shall be traceable to the information provided in DO-1 (Initial) or DO-1(Final)) and DO-2.

As required by the Schedule, the offeror shall specify the Applicable Financial Index used with its source and date, the financing term of the project (in years), the index rate (derived for the project's term from the financial index), the added premium being

applied to amortize the investment (up to the maximum Added Premium, based on Schedule B-2), and the resultant Project Interest Rate. The effectivity of the proposed Project Interest Rate is also required to be identified on the Schedule.

Schedule DO-4 C First Year Energy and Cost Savings by ECM, Technology Category, and Delivery Order

Schedule DO-4 shall be submitted for all delivery order project proposals. Schedule DO-4 presents a summary of the proposed estimated annual cost savings that will be achieved following the installation of the ECM's included in the delivery order proposal. Both the ECM number and technology category, per Section C.2 numbering, shall be provided, as well as an adequate description of each ECM and the other indicated energy information. The ECM numbers indicated in this Schedule shall be consistent throughout the offeror's proposal, both technical and price. The annual cost savings requested for each ECM shall be broken down into energy and O&M cost savings. The energy savings shall be presented in the energy type consumed by the equipment and also converted to Btu's for a project summary. Subsequent demand and dollar savings shall be derived from the utility rates presented in the DO RFP for the project site.

Contractors/Offerors shall provide adequate supporting documentation for the estimated annual cost savings submitted in Schedule DO-4, to include whatever detail is pertinent to the specific project.

H.22 REVIEW OF INITIAL PROPOSALS FOR DELIVERY ORDER ECM PROJECTS

H.22.1 CONTRACTOR IDENTIFIED PROJECT PROPOSALS

The Government will review the initial proposal submitted, make a determination as to whether the Contractor-Identified project is a project that the Government wants to pursue further, and notify the contractor of this determination. Government comments on the Initial Proposal will be provided to the contractor within thirty (30) days of its submission. The contractor response to Government comments shall likewise be within thirty (30) days.

Since the Initial proposal for a Contractor-Identified project is based largely upon limited site investigations, the agency is encouraged to limit their level of detail during the review. Foremost consideration should be given to whether the work scope, conditions, and contract term offered in the proposal provide sufficient merit to allow the Contractor to further develop the project in greater detail. As part of this, there should be consideration of whether the estimated pricing and energy savings proposed support the technical proposal, and are realistic.

If the Government determines to pursue the Contractor-Identified project, a Notice of Intent to Award (NOI) will be issued within thirty (30) days of the contractor's final responses to any Government comments and questions concerning the Initial Proposal. The NOI will request a Detailed Energy Survey and final proposal in accordance with the requirements for proposal contents included in Sections H.23 and H.24 of this contract. A DO RFP will be issued by the Government either concurrent with the NOI, or as agreed upon by the parties. Evaluation of the DES/final proposal by the Government will be in accordance with Section H.25, or as modified and defined in the DO RFP.

H.22.2 GOVERNMENT IDENTIFIED PROJECT PROPOSALS

When the Government determines to pursue a Government Identified delivery order process as opposed to the process for a Contractor-identified project, a somewhat more formal selection of the Contractor occurs. Unlike with the Contractor-Identified process, the DO RFP, with an associated technical data package and/or site description, is issued prior to receipt of an Initial Proposal. The required proposal contents for the Initial Proposal remain the same as for one submitted for a Contractor Identified project, as described in Section H.21 above. However, more defined evaluation criteria to select among potentially several eligible contractors are usually desired and advisable. Therefore, the Contractors submitting Initial Proposals will be evaluated in accordance with the following evaluation factors, unless otherwise modified in a specific DO RFP:

H.22.2.1 Technical Evaluation Factors

Factor 1 - ECM Descriptions & Projected Energy Savings

Factor 2 - Energy Baseline & ECM Performance Measurement

Factor 3 - Management Approach

Factors 1 and 2 are most important and Factor 3 is least important.

A. Factor 1 - ECM Descriptions and Proposed Energy Savings

Each offeror will be evaluated on his/her demonstrated capability to provide each of the site specific required technology categories and ability to accurately project energy savings. Elements to be evaluated include:

1. The proven technical feasibility, reasonableness, and acceptability of the proposed ECMs.
2. The level and reasonableness of the proposed energy savings.
3. Verification that the energy analysis is based on sound assumptions and engineering principles; verification that impacts on Government facilities and operations are acceptable and reasonable; the suitability and service life of selected equipment for

each proposed ECM; proposed environmental impacts are adequately addressed; and verification that proposed project implementation schedules are realistic and reasonable.

B. Factor 2 - Energy Baseline and ECM Performance Measurement

Offerors will be evaluated on the following measurement elements and capabilities:

1. The baseline and M&V plan demonstrates a clear understanding of compliance with M&V protocols.
2. The proposed M&V approach is feasible, reasonable and acceptable for the proposed project ECMs.

C. Factor 3 - Management Approach

Each offeror will be evaluated on the following elements of site management capabilities: the proposed organization to manage and accomplish the proposed ECMs is well suited and addresses all key elements to ensure successful project implementation and maintenance of ECM performance; offeror's organization structure is adequate to provide required operation and maintenance of installed ECMs, whether operation and maintenance is done by the contractor or by the Government; and offeror's training plan is appropriate and suitable for the proposed level of Government O&M responsibility.

If the Government determines to pursue the Government-Identified project, the selected contractor will be notified by the Agency CO of their selection, and a Notice of Intent to Award, with an associated revised DO RFP will be issued within thirty (30) days of the selection. This NOI and DO RFP will request a complete proposal in accordance with the requirements for a DES/final proposal contents included in Sections H.23 and H.24 of the contract, and it will be evaluated in accordance with the evaluation criteria in Section H.25 of this contract, as and if modified by the revised DO RFP.

H.22.2.2 Price Proposal Evaluation Factors

Price proposals will be evaluated to assess:

- (a) The completeness and traceability of the proposed price (i.e. sum of annual contractor payments) to the offeror's technical approach to and understanding of the ECM project proposed.
- (b) The reasonableness as well as realism of the proposed price (payments), relative to the technical project proposed, and the estimated savings indicated as achievable, based on an evaluation of the DO Schedules submitted by the offeror, as well as the pricing detail provided to support them.

(c) That guaranteed annual energy cost savings exceed the annual contractor payment for each year of the performance period.

(d) That the mark-up(s) and added premiums proposed for the project are in accordance with the negotiated maximums for the Contractor, as identified in Schedules B-1 and B-2 of this contract. (See Part III, Section J, Attachment 3.)

H.23 DETAILED ENERGY SURVEY

The selected contractor for both Contractor and Government-Identified projects, shall, within the time specified in the DO RFP from the receipt of Government's Notice of Intent to award, conduct a Detailed Energy Survey (DES) of facilities and energy systems at the project site to confirm the contractor's ability to achieve the estimated annual cost savings [Schedule DO-1 (Initial), column (a)] indicated in the Initial Proposal, or in any event to identify and confirm sufficient annual cost savings to cover the annual costs of the agreed upon post-DES project that is planned to be negotiated.

The final proposal shall include the results of the DES that document the relevant existing conditions of applicable Government facilities, including but not limited to:

- \$ Building physical conditions
- \$ Hours of use or occupancy
- \$ Area of conditioned space
- \$ Inventory of energy-consuming equipment or systems
- \$ Energy-consuming equipment operating conditions and loads
- \$ Baseline weather (i.e., Cooling and Heating Degree Days
- \$ First Year Energy and energy cost savings estimates
- \$ Site specific M&V Plan
- \$ Proposed construction and M&V schedules.

For each ECM proposed, the Contractor shall provide a detailed energy analysis documenting the proposed annual energy savings performance of the ECM after installation, startup and testing. Documentation of the analysis shall include, at a minimum:

Offeror's assumptions on current facility or energy system operating conditions;
Offeror's assumptions on proposed facility or energy system operating conditions;

Energy savings calculations using formulae and procedures based on accepted engineering principles, including synergistic effects of other ECMs;
Cite references used for data, assumptions or empirical formulae.

The DES/final proposal may indicate that existing conditions vary from Government provided or contractor acquired data or assumptions proposed for any of the individual ECMs. Any variance between survey findings and the assumptions made for individual

ECMs shall require the contractor to revise all supporting documentation for each affected ECM in its proposal. These revisions and supporting documentation shall be included as part of the DES documentation in the final proposal. The DES/final proposal shall also fully document the existing building conditions and proposed energy baseline. The DES results identified in the final proposal ultimately establish the mutual agreement of the parties on the energy and facility baseline conditions and site specific M&V Plan for the delivery order. The Contractor shall revise the DES/final proposal based on Government review and comments, as required and agreed to by the parties handling a specific delivery order project, and at a minimum based on final negotiations.

H.24 REQUIREMENTS FOR FINAL PROPOSAL CONTENTS FOR DELIVERY ORDER ECM PROJECTS

Proposals shall be submitted initially on the most favorable terms from a price and technical standpoint to the Government. The Government reserves the right to accept or reject the proposal without further discussions. As required by the DO RFP for a delivery order project, the contractor shall submit a technical and price proposal, in both electronic (Word and Excel) and hardcopy formats, as follows:

(NOTE: Any limitations on size of proposals will be indicated in the DO RFP for a project.)

H.24.1 Format for Technical Proposal:

The technical proposal shall be prepared in the following format:

ECM Descriptions and Projected Energy Savings (including ECM Summary Schedule for Delivery Order)

The contractor shall complete and submit Delivery Order Schedule DO-4 summarizing all ECMs proposed for the delivery order.

For each ECM proposed, the contractor shall submit narrative information for items, as applicable, in the format specified below:

- (a) ECM No. _____
- (b) ECM Title and Executive Summary
 - 1. Detailed Description of ECM
 - 2. Location Affected
 - 3. ECM Interface with Government Equipment

4. Proposed Equipment Identification - Provide manufacturer, model number and optional equipment proposed for each ECM component, including manufacturer's literature and specifications.

5. Physical Changes C List major physical changes to equipment or facilities required to install proposed ECM such as relocation or removal of equipment.

6. First Year Energy Savings Proposed

(a) Proposed ECM annual energy savings (in all applicable energy/demand reduction units)

7. Utility Interruptions C Specify extent of any utility interruptions needed for installation of proposed ECM.

8. Agency Support Required C Specify any government agency support required during implementation of the ECM.

Potential Environmental Impact C Briefly describe any potential environmental impact resulting from installed ECM.

ECM Project Schedule C Provide a project schedule to include the duration of the following key phases:

(a) Engineering/Design/Acceptance.

(b) Equipment Procurement/Lead Time (i.e., date required to acquire equipment and delivery on-site).

(c) Installation & Commissioning

B. Energy Baseline and ECM Performance Measurement

The contractor shall describe how it will provide a complete measurement and verification (M&V) plan for the proposed delivery order. The plan shall include, but not be limited to:

1. M&V Overview C Description of the measurement plan proposed for this project referenced to the FEMP M&V Guide.

2. Specific M&V Plan C Define a site specific plan, which must include the following elements for each proposed ECM:

(a) Objectives C a statement of what is to be estimated (i.e., gross annual Kwh savings on a project basis).

- (b) Parameters to be monitored - indicate parameters to be recorded that will be used in the estimation of annual energy savings, including variable load, hours of operation, installation status of measures, etc.; other parameters related to secondary objectives, such as in the case of lighting, may include reduction in lighting levels.
- (c) Sampling plan (if required), including:
1. Designation of usage groups C define usage groups for areas with similar characteristics.
 2. Calculation of population(s) and sample sizes(s) by usage group C present the calculation and assumptions used to determine sample size by each usage group area.
- (d) Data collection plan, including:
1. Specify data to be collected in terms of parameters, unit of measurement, points of measurements, length of time and intervals of measurements; raw, meter data (if available) as well as analyzed and summary data must be obtained.
 2. Identification of instrumentation and metering equipment name and documentation on equipment specifications of monitoring devices.
 3. Calibration of equipment C describe protocols for calibrating equipment.
 4. Data gathering and quality control C describe quality control procedures for checking completeness and accuracy of the recorded data.
 5. Period of monitoring C specify periods of monitoring including duration and frequency.
 - a. Analysis Method C describe in detail the method of analysis to estimate annual energy savings based on recorded data; include a discussion on relevant equations and assumptions, and document all calculations and assumptions.
3. Pre-Installation energy and facility performance baseline including:
- equipment/systems,
 - baseline energy use,
 - factors which influence baseline energy use, and

- system performance factors (e.g., lighting levels, temperature set points).

- Post-installation facility conditions including
- equipment/systems,

(b) post-installation energy use, and/or factors that influence post-installation energy use.

(d) energy provided by PV

5. Determination of energy savings based on the selected approach and the pre and post installation conditions.
6. Plan for future periodic (annual) measurements of ECM and facility performance and calculation of current period (year) savings.
7. Plan for resolving disputes regarding issues such as baseline, baseline adjustment, energy savings calculation and the use of periodic measurements.

C. Management Approach

§ Organization. Show the organization for implementing and managing the site specific project. Proposed organization shall contain the responsibilities of each element shown on the organization chart. Identify primary personnel by name in each element. Show the lines of authority within the organization. If portions of the project are to be subcontracted (e.g., design of an energy conservation system), identify the subcontracted function, and which element of the contractor's organization will manage the subcontract(s).

§ Risk/Responsibility Matrix. The contractor shall complete and submit with its Final Proposal a final responsibility matrix detailing its proposed approach or method to address each area in the Risk/Responsibility Matrix. Final Proposal submission of this Risk/Responsibility Matrix should reflect revisions based on results of agency discussions and agreements with the contractor on the Risk/Responsibility Matrix it submitted in the Initial Proposal. The Risk/Responsibility Matrix is provided by DOE to agency personnel for use during their projects, and is available from the Contracting Officer or her COR. Its format and content changes as appropriate. The agency will review and provide comments, as required, on its assessment of the contractor and agency roles and responsibilities based on this contractor submittal. The Contractor shall submit a Final Proposal Risk/Responsibility Matrix based on agency comments and requests.

§ Operations, Maintenance, Repair and Replacement. Show the organization structure and describe the approach for performance of the delivery order's operations, maintenance and repair and replacement requirements.

§ ECM Training. Describe in detail how training for each ECM will be provided for Government personnel. Approach should be customized depending on the level of Operations and Maintenance responsibility to be assumed by Government personnel.

H.24.2 Format for Price Proposal:

Based on the DES results, the selected contractor shall submit a completed Schedule DO-1 (Final), reflecting the contractor's DES annual cost savings [Schedule DO-1 (Final), column (a)]. The selected contractor shall submit as part of his final proposal a copy of the detailed energy survey findings, data, and calculations used to support the Schedule DO-1 (Final). The instructions and format for the Schedule DO-1 (Final) are provided below.

The selected contractor shall also resubmit Schedules DO-2, DO-3, and DO-4 reflecting changes as a result of the DES. (Refer to Section H.21(e) for descriptions of these schedules.)

The Contractor/Offeror shall provide adequate supporting documentation for the Final Proposal implementation and performance period pricing submitted in Schedules DO-2 and DO-3 for the final proposal, to include whatever detail is pertinent to the specific project. This information is required as proposal backup to permit evaluation of price reasonableness for the scope of the project proposed. (If inflation is included in the calculations, an explanation of the method used and rationale therefore must be provided.) The following provides what is considered a minimum level of detail required to meet the requirement of adequate supporting documentation.

Supporting documentation shall be organized by the chronology of proposed contractor work as follows:

Section 1 - Summarize Project level Expenses from Project Development through DO Award (no ECM breakout required) to include:

- DES (labor hours and cost delineated by general rate categories)
- Pre-Design (labor hours and cost delineated by general rate categories)
- Project Management (labor hours and cost delineated by general rate categories)
- Subcontracts (delineated by subcontractor)
- Travel and Expenses
- Total Expenses through DO Award

Section 2 - Summarize Implementation Period Pricing allocated by ECM (project level implementation expenses shall be allocated to ECMs by appropriate method) to include:

- Equipment/Material (delineated by ESCO and subcontractors)
- Post DO Award Design (labor hours and cost delineated by general rate categories)

- Project Management (labor hours and cost delineated by general rate categories)
- Installation Labor (delineated by ESCO and subcontractors)
- Testing (delineated by ESCO and subcontractors)
- Commissioning (delineated by ESCO and subcontractors)
- M&V (delineated by ESCO and subcontractors)
- Other (e.g. bonds, quality/safety compliance, training, documents/submittals)

Section 3 - Summarize Performance Period Expenses by Project (aligned with proposed DO-3 line item expenses) to include, as applicable:

- Project Management (delineated by material and labor)
- Operations (delineated by material and labor)
- Maintenance (delineated by material and labor)
- Repair & Replacement (delineated by material and labor)
- M&V (delineated by material and labor)
- Other (delineated by material and labor)

Labor Hours Cost shall be delineated by general rate categories.

Support provided for proposed subcontractor efforts, if based on and evidenced by competitive quotations, need not be supported in any greater detail, unless the low bids are not proposed for use in the delivery order project, and/or unless otherwise required by the DO RFP.

The Contractor/Offeror shall likewise provide adequate supporting documentation for the estimated annual cost savings submitted in Schedule DO-4, to include whatever detail is pertinent to the specific project.

Further, the Contractor/Offeror shall indicate the elements of indirect expense included in the proposed markups for the specific delivery order project.

Schedule DO-5 shall also be provided as part of the final proposal. The instructions and format for Schedule DO-5 are also provided below.

Schedule DO-1 (Final) C Guaranteed Annual Cost Savings and Annual Contractor Payments

Schedule DO-1 (Final) shall be submitted to present the selected contractor's guaranteed annual energy savings, annual contractor payments and annual cancellation ceilings. Based on the detailed energy survey results, the selected contractor only shall submit a completed Schedule DO-1 (Final), reflecting the contractor's guaranteed annual cost savings in column (b). The selected contractor shall submit a copy of the detailed energy survey findings, data, and calculations used to support Schedule DO-1 (Final) with the DO-1 (Final) submission.

The contractor shall receive monthly payments based on the negotiated annual fixed payment schedule, as established in the Schedule DO-1(Final), column (c), and included in the delivery order award. This represents the delivery order price and will be supported by the information submitted in the other DO Schedules submitted with the delivery order proposal, originally or as revised as part of the DES.

Schedule DO-5 C Annual Cancellation Ceiling Schedule

Schedule DO-5 shall be submitted for all final delivery order project proposals. Column (b) of Schedule DO-5, "Total Cancellation Ceiling," is a presentation of proposed, and later negotiated, annual cancellation ceilings to establish the maximum termination liability in the event of contract cancellation or termination. Actual termination charges will be negotiated as part of any cancellation or termination settlement, per established FAR requirements. Column (a) of Schedule DO-5, "Outstanding Capital Investment," is a fixed subset of the Total Cancellation Ceiling in Column (b). It constitutes the remaining unamortized principal on Total Amount Financed for each time period specified in the Schedule DO-5, plus any prepayment charges as negotiated and included in the pricing (including financing) of the project.

All of the above schedules are provided in Part III, Section J, Attachment 4 to this contract.

H.24.3 Government Response to Final Proposal

Within thirty (30) days of submission of the contractor's final proposal, the Government will complete its review and provide comments to the contractor.

H.25 FINAL PROPOSAL EVALUATION FOR GOVERNMENT IDENTIFIED DELIVERY ORDER ECM PROJECTS

Proposals will be evaluated using the criteria specified herein. Proposals will be evaluated using factors in two (2) categories, technical and price. Technical Evaluation Factors are more important than Price Evaluation Factors. The Government is more concerned about obtaining superior technical features (e.g., comprehensive technical proposals) than making an award at the lowest cost to the Government. However, the Government will NOT make an award at a price premium it considers disproportionate to the benefits associated with a technically superior proposal, nor where the price proposal does not substantiate the technical approach and estimated savings. Therefore, the Government will select the contractor whose proposal is the best value to the Government to perform the delivery order, based on technical AND price evaluations. Awards after selection will be conditioned upon the selected contractor meeting the preaward requirements as specified in the provision at Section H.26.

H.25.1 Technical Evaluation Factors

Factor 1 C ECM Descriptions & Projected Energy Savings

Factor 2 C Energy Baseline & ECM Performance Measurement

Factor 3 C Management Approach

Factors 1 and 2 are most important and Factor 3 is least important.

A. Factor 1 C ECM Descriptions and Proposed Energy Savings

Each offeror will be evaluated on his/her demonstrated capability to provide each of the site specific required technology categories and ability to accurately project energy savings. Elements to be evaluated include:

1. The proven technical feasibility, reasonableness, and acceptability of the proposed ECMs
2. The level and reasonableness of the proposed energy savings
3. Verification that the energy analysis is based on sound assumptions and engineering principles; verification that impacts on Government facilities and operations are acceptable and reasonable; the suitability and service life of selected equipment for each proposed ECM; proposed environmental impacts are adequately addressed; and verification that proposed project implementation schedules are realistic and reasonable.

B. Factor 2 C Energy Baseline and ECM Performance Measurement

Offerors will be evaluated on the following measurement elements and capabilities:

1. The baseline and M&V plan demonstrates a clear understanding of compliance with M&V protocols.
2. Verification that the sampling and data collection plans are acceptable and reasonable and that they are based on proposed ECMs
3. Methods to establish pre and post-installation conditions and determine energy savings are adequate and reasonable
4. Periodic measurement approaches for ECMs and facility performance are adequate and reasonable to provide assurance of continued effective monitoring of ECM performance.

C. Factor 3 C Management Approach

Each offeror will be evaluated on the following elements of site management capabilities: the proposed organization to manage and accomplish the proposed ECMs is well suited and addresses all key elements to ensure successful project implementation and maintenance of ECM performance; offeror's organization structure is adequate to provide required operation and maintenance of installed ECMs, whether operation and maintenance is done by the contractor or by the Government; and offeror's training plan is appropriate and suitable for the proposed level of Government O&M responsibility.

H.25.2 Price Proposal Evaluation Factors

Price proposals will be evaluated to assess:

- (a) The completeness and traceability of the proposed price (i.e. sum of annual contractor payments) to the offeror's technical approach to and understanding of the ECM project proposed.
- (b) The reasonableness as well as realism of the proposed price (payments), relative to the technical project proposed, and the estimated savings indicated as achievable, based on an evaluation of the DO Schedules submitted by the offeror, as well as the pricing detail provided to support them.
- (c) That guaranteed annual energy cost savings exceed the annual contractor payment for each year of the performance period.

(d) That the mark-up(s) and added premiums proposed for the project are in accordance with the negotiated maximums for the contractor, as identified in Schedules B-1 and B-2. (See Part III, Section J, Attachment 3.)

The price proposal will not be point scored.

Unless otherwise specified in the DO RFP, if the Schedule DO-1(Final) guaranteed annual cost savings are less than 90% of Schedule DO-1(Initial) estimated annual cost savings contained in the contractor's Initial Proposal, then the Government may select the next ranked contractor's proposal for award (for Government-Identified process projects), where award is again subject to meeting the preaward requirements. If the Government selects the next ranked contractor's proposal, the Government shall not be responsible for any costs incurred by the previously selected contractor as a result of this delivery order requirement and procedure.

Even if the Schedule DO-1(Final) guaranteed annual cost savings are within the specified percentage of the estimated annual cost savings and negotiations are necessary, the Government may select the next ranked contractor's proposal, if the selected contractor does not negotiate in good faith. In these cases, the Government shall not be responsible for any costs incurred, such as proposal preparation costs or the costs incurred in conducting the detailed survey.

H.26 PREAWARD REQUIREMENTS

1. Pre-Award Requirements - Project Financing by Contractor for Delivery Orders:

(a) If the selected contractor is to provide its own financing for project execution, the selected contractor shall have up to [*time specified in delivery order*], from Government's acceptance of the Detailed Energy Survey, Guaranteed Annual Cost Savings [Schedule DO-1(Final)], to provide evidence of surety's commitment for bonding of proposed delivery order's building(s) and site per paragraph H.17.

(b) Should the selected contractor fail, within the specified timeframe, to provide acceptable evidence of bonding capability, the Government may determine the offer not acceptable.

2. Pre-Award Requirements - Project Financing by Third Party:

(a) If the selected contractor requires third party financing for project execution, the selected contractor shall have up to [*time specified in delivery order*], from Government's acceptance of the Detailed Energy Survey, Guaranteed Annual Cost Savings (Schedule DO-1, Final), to provide for delivery order projects proposed: (1) proof of financing commitment; and (2) evidence of surety's commitment for bonding per H.17.

(b) Proof of financing shall be provided by written statement(s) from the financier(s), signed by authorized corporate officer(s) indicating a firm commitment of funds for project financing.

(c) The Government recognizes the unique aspects of third party financing of energy savings performance contracts. The Government is willing to discuss and consider third party financier needs for any notification(s) during the delivery order term. (See also Section H.18, Protection of Financier's Interest.)

(d) Should the selected contractor fail, within the specified timeframe, to provide proof of financing commitment and acceptable evidence of bonding capability, the Government may determine the offer not acceptable.

PART II c CONTRACT CLAUSES

SECTION I c CONTRACT CLAUSES

FAR 52.252-2 CLAUSES INCORPORATED BY REFERENCE (JUN 1988)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The provisions incorporated by reference are both Federal Acquisition Regulation (FAR) clauses and Department of Energy Acquisition Regulation (DEAR) clauses. All of these provisions are available on the Internet, in full text, at: <http://farsite.hill.af.mil/vffar1.htm>, and <http://farsite.hill.af.mil/vfdoe1.htm> respectively.

Clause No.	Clause Name
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52.202-1	DEFINITIONS (OCT 1995), ALTERNATE I (APR 1984)
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This FAR clause, 52-202-1, is hereby modified by substituting the following for paragraph (a) of the clause:

(a) "Head of Agency" means the Secretary, Deputy Secretary or Under Secretary of the Department of Energy and the Chairman, Federal Energy Regulatory Commission.

This same clause is further modified by substituting the following for paragraph (c) of this clause:

(c) The term "DOE" means the Department of Energy and "FERC" means the Federal Energy Regulatory Commission.

52.203-3	GRATUITIES (APR 1984)
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52.203-5	COVENANT AGAINST CONTINGENT FEES (APR 1984)
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52.203-6 RESTRICTIONS ON SUBCONTRACTOR SALES TO THE
GOVERNMENT (JUL 1995)

52.203-7 ANTI-KICKBACK PROCEDURES (JUL 1995)

52.203-10 PRICE OR FEE ADJUSTMENT FOR ILLEGAL OR IMPROPER
ACTIVITY (JAN 1997)

52.203-12 LIMITATION ON PAYMENTS TO INFLUENCE CERTAIN FEDERAL
TRANSACTIONS (JUN 1997)

52.204-5 WOMEN-OWNED BUSINESS (OTHER THAN SMALL BUSINESS)
(MAY 1999)

52.204-6 DATA UNIVERSAL NUMBERING SYSTEM (DUNS) NUMBER (JUN
1999)

PROTECTING THE GOVERNMENT'S INTEREST WHEN
SUBCONTRACTING WITH CONTRACTORS DEBARRED, SUSPENDED, OR
PROPOSED FOR DEBARMENT (JUL 1995)

52.219-8 UTILIZATION OF SMALL BUSINESS CONCERNS (OCT 2000)

52.219-9 SMALL BUSINESS SUBCONTRACTING PLAN (OCT 2000)

52.219-16 LIQUIDATED DAMAGES-SUBCONTRACTING PLAN (JAN 1999)

52.222-1 NOTICE TO THE GOVERNMENT OF LABOR DISPUTES (FEB 1997)

52.222-3 CONVICT LABOR (AUG 1996)

52.222-4 CONTRACT WORK HOURS AND SAFETY STANDARDS ACT -
OVERTIME COMPENSATION (SEP 2000)

52.222-26 EQUAL OPPORTUNITY (FEB 1999)

52.222-35 AFFIRMATIVE ACTION FOR DISABLED VETERANS AND
VETERANS OF THE VIETNAM ERA (APR 1998)

52.222-36 AFFIRMATIVE ACTION FOR WORKERS WITH DISABILITIES (JUN
1998)

52.222-37 EMPLOYMENT REPORTS ON SPECIAL DISABLED VETERANS
AND VETERANS OF THE VIETNAM ERA (JAN 1999)

52.223-6 DRUG-FREE WORKPLACE (JAN 1997)

52.223-14 TOXIC CHEMICAL RELEASE REPORTING (OCT 2000)

52.225-11 BUY AMERICAN ACT - BALANCE OF PAYMENTS PROGRAM -
CONSTRUCTION MATERIAL UNDER TRADE AGREEMENTS (FEB 2000)

52.227-1 AUTHORIZATION AND CONSENT (JUL 1995)

52.227-2 NOTICE AND ASSISTANCE REGARDING PATENT AND
COPYRIGHT INFRINGEMENT (AUG 1996)

52.228-5 INSURANCE c WORK ON A GOVERNMENT INSTALLATION
(JAN 1997)

52.229-3 FEDERAL, STATE AND LOCAL TAXES (JAN 1991)

52.229-5 TAXES - CONTRACTS PERFORMED IN THE U.S. POSSESSIONS
OR PUERTO RICO (APR 1984)

52.232-17 INTEREST (JUN 1996)

52.232-23 ASSIGNMENT OF CLAIMS (JAN 1986)

52.233-1 DISPUTES (DEC 1998), ALTERNATE I (DEC 1991)

52.233-3 PROTEST AFTER AWARD (AUG 1996)

52.236-13 ACCIDENT PREVENTION (NOV 1991)

52.242-13 BANKRUPTCY (JUL 1995)

52.244-5 COMPETITION IN SUBCONTRACTING (DEC 1996)

52.249-2 TERMINATION FOR CONVENIENCE OF GOVERNMENT (FIXED
PRICE) (SEP 1996)

952.227-13 PATENT RIGHTS c ACQUISITION BY THE GOVERNMENT (SEP
1997)

952.208-70 PRINTING (APR 1984)

952.209-72 ORGANIZATIONAL CONFLICTS OF INTEREST (JUN 1997)

970.5204-2 INTEGRATION OF ENVIRONMENT, SAFETY AND HEALTH INTO
WORK PLANNING AND EXECUTION (JUN 1997)

970.5204-59 WHISTLEBLOWER PROTECTION FOR CONTRACTOR
EMPLOYEES (APR 1999)

THE FOLLOWING CLAUSES ARE APPLICABLE TO
THE CONSTRUCTION PHASE(S) OF THE CONTRACT AND DELIVERY
ORDERS

52.222-6 DAVIS-BACON ACT (FEB 1995)

52.222-7 WITHHOLDING OF FUNDS (FEB 1988)

52.222-8 PAYROLLS AND BASIC RECORDS (FEB 1988)

52.222-9 APPRENTICES AND TRAINEES (FEB 1988)

52.222-10 COMPLIANCE WITH COPELAND ACT REQUIREMENTS
(FEB 1988)

52.222-11 SUBCONTRACTS (LABOR STANDARDS) (FEB 1988)

52.222-12 CONTRACT TERMINATION c DEBARMENT (FEB 1988)

52.222-13 COMPLIANCE WITH DAVIS-BACON AND RELATED ACT
REGULATIONS (FEB 1988)

52.222-14 DISPUTES CONCERNING LABOR STANDARDS (FEB 1988)

52.222-15 CERTIFICATION OF ELIGIBILITY (FEB 1988)

52.222-27 AFFIRMATIVE ACTION COMPLIANCE REQUIREMENTS FOR
CONSTRUCTION (FEB 1999)

52.227-4 PATENT INDEMNITY c CONSTRUCTION CONTRACTS (APR 1984)

52.228-2 ADDITIONAL BOND SECURITY (OCT 1997)

52.236-2 DIFFERING SITE CONDITIONS (APR 1984)

52.236-3 SITE INVESTIGATION AND CONDITIONS AFFECTING THE
WORK (APR 1984)

- 52.236-5 MATERIAL AND WORKMANSHIP (APR 1984)
- 52.236-6 SUPERINTENDENCE BY THE CONTRACTOR (APR 1984)
- 52.236-7 PERMITS AND RESPONSIBILITIES (NOV 1991)
- 52.236-8 OTHER CONTRACTS (APR 1984)
- 52.236-9 PROTECTION OF EXISTING VEGETATION, STRUCTURES,
EQUIPMENT, UTILITIES AND IMPROVEMENTS (APR 1984)
- 52.236-10 OPERATIONS AND STORAGE AREAS (APR 1984)
- 52.236-11 USE AND POSSESSION PRIOR TO COMPLETION (APR 1984)
- 52.236-12 CLEANING UP (APR 1984)
- 52.236-14 AVAILABILITY AND USE OF UTILITY SERVICES (APR 1984)
- 52.236-15 SCHEDULES FOR CONSTRUCTION CONTRACTS (APR 1984)
- 52.236-21 SPECIFICATION AND DRAWINGS FOR CONSTRUCTION (FEB
1997)
- 52.243-4 CHANGES (AUG 1987)
- 52.246-13 INSPECTION - DISMANTLING, DEMOLITION, OR REMOVAL OF
IMPROVEMENTS (AUG 1996)
- 52.246-19 WARRANTY OF SYSTEMS AND EQUIPMENT UNDER
PERFORMANCE SPECIFICATIONS OR DESIGN CRITERIA (DEC 1989) c
ALTERNATE III (DEC 1989)
- 52.246-21 WARRANTY OF CONSTRUCTION (MAR 1994)
- 52.249-10 DEFAULT (FIXED PRICE CONSTRUCTION) (APR 1984)

THE FOLLOWING CLAUSES ARE APPLICABLE TO
THE SERVICES PHASE(S) OF THE CONTRACT AND DELIVERY ORDERS

- 52.222-41 SERVICE CONTRACT ACT OF 1965, AS AMENDED (MAY 1989)
- 52.222-42 STATEMENT OF EQUIVALENT RATES FOR FEDERAL HIRES
(MAY 1989)

52.222-43 FAIR LABOR STANDARD ACT AND SERVICE CONTRACT ACT -
PRICE ADJUSTMENTS (MULTIPLE YEAR AND OPTION CONTRACT) (MAY
1989)

52.227-3 PATENT INDEMNITY (APR 1984)

52.232-1 PAYMENTS (APR 1984)

52.232-8 DISCOUNTS FOR PROMPT PAYMENT (MAY 1997)

52.232-25 PROMPT PAYMENT (JUN 1997)

52.243-1 CHANGES c FIXED PRICE (AUG 1987) ALTERNATE I (APR 1984)

52.246-25 LIMITATION OF LIABILITY c SERVICES (FEB 1997)

52.249-8 DEFAULT (FIXED PRICE SUPPLY AND SERVICES) (APR 1984)

APPENDIX B- RISK/RESPONSIBILITY MATRIX FOR ESPC PROJECTS

ESPC Contract Risk/Responsibility Matrix

1. RESPONSIBILITY/DESCRIPTION	ESCO PROPOSED APPROACH	AGENCY ASSESSMENT
1. Financial		
<p>a. Interest rates: Neither the Contractor nor the agency has significant control over prevailing interest rates. During all phases of the project, interest rates will change with market conditions. Higher interest rates will increase project cost, financing/project term, or both. The timing of the Contract / Delivery Order signing may impact the available interest rate and project cost.</p>		
<p>b. Energy prices: Neither the Contractor nor the agency has significant control over actual energy prices. For calculating savings, the value of the saved energy may either be constant, change at a fixed inflation rate, or float with market conditions. If the value changes with the market, falling energy prices place the Contractor at risk of failing to meet cost savings guarantees. If energy prices rise, there is a small risk to the agency that energy saving goals might not be met while the financial goals are. If the value of saved energy is fixed (either constant or escalated), the agency risks making payments in excess of actual energy cost savings. Clarify how future energy costs will be treated.</p>		

<p>c. Construction costs: The Contractor is responsible for determining construction costs and defining a budget. In a fixed-price design/build Contract, the agency assumes little responsibility for cost overruns. However, if construction estimates are significantly greater than originally assumed, the Contractor may find that the project or measure is no longer viable and drop it before Contract award. In any design/build Contract, the agency loses some design control. Clarify design standards and the design approval process (including changes) and how costs will be reviewed.</p>		
<p>d. M & V costs: The agency assumes the financial responsibility for M & V costs directly or through the Contractor. If the agency wishes to reduce M & V cost, it may do so by accepting less rigorous M & V activities with more uncertainty in the savings estimates. Clarify how project savings are being verified (e.g., equipment performance, operational factors, energy use) and the impact on M&V costs.</p>		

<p><u>e. Non-Energy Cost Savings:</u> The agency and the ESCO may agree that the project will include savings from <i>recurring</i> and/or <i>one-time</i> costs. This may include one-time savings from avoided expenditures for projects that were appropriated but will no longer be necessary. Including one-time cost savings before the money has been appropriated entails some risk to the agency. Recurring savings generally result from reduced O&M expenses or reduced water consumption. These O&M and water savings must be based on actual spending reductions. Clarify sources of non-energy cost savings and how they will be verified.</p>		
<p><u>f. Delays:</u> Both the Contractor and the agency can cause delays. Failure to implement a viable project in a timely manner costs the agency in the form of lost savings, and can add cost to the project (e.g. construction interest, re-mobilization). Clarify schedule and how delays will be handled.</p>		
<p><u>g. Major changes in facility:</u> The agency (or Congress) controls major changes in facility use, including closure. Clarify responsibilities in the event of a premature facility closure, loss of funding, or other major change.</p>		
<p>2. Operational</p>		

<p>a. Operating hours: The agency generally has control over operating hours. Increases and decreases in operating hours can show up as increases or decreases in “savings” depending on the M&V method (e.g., operating hours multiplied by improved efficiency of equipment vs. whole-building/utility bill analysis). Clarify whether operating hours are to be measured or stipulated and what the impact will be if they change. If the operating hours are stipulated, the baseline should be carefully documented and agreed to by both parties.</p>		
<p>b. Load: Equipment loads can change over time. The agency generally has control over hours of operation, conditioned floor area, intensity of use (e.g. changes in occupancy or level of automation). Changes in load can show up as increases or decreases in “savings” depending on the M & V method. Clarify whether equipment loads are to be measured or stipulated and what the impact will be if they change. If the equipment loads are stipulated, the baseline should be carefully documented and agreed to by both parties.</p>		
<p>c. Weather: A number of energy efficiency measures are affected by weather. Neither the Contractor nor the agency has control over the weather. Changes in weather can increase or decrease “savings” depending on the M&V method (e.g. equipment run hours multiplied by efficiency improvement vs. whole-building/utility bill analysis). If weather is “normalized,” actual savings could be less than payments for a given year, but will average out over the long run. Clearly specify how weather corrections will be performed.</p>		

<p><u>d. User participation:</u> Many energy conservation measures require user participation to generate savings (e.g., control settings). The savings can be variable and the Contractor may be unwilling to invest in these measures. Clarify what degree of user participation is needed and utilize monitoring and training to mitigate risk. If performance is stipulated, document and review assumptions carefully and consider M&V to confirm the capacity to save (e.g., confirm that the controls are functioning properly).</p>		
<p>3. Performance</p>		
<p><u>a. Equipment performance:</u> Generally the Contractor has control over the selection of equipment and is responsible for its proper installation, commissioning, and performance. Generally the Contractor has responsibility to demonstrate that the new improvements meet expected performance levels including specified equipment capacity, standards of service, and efficiency. Clarify who is responsible for initial and long-term performance, how it will be verified, and what will be done if performance does not meet expectations.</p>		
<p><u>b. Operations:</u> Responsibility for operations is negotiable, and it can impact performance. Clarify responsibility for operations, the implications of equipment control, how changes in operating procedures will be handled, and how proper operations will be assured.</p>		

<p><u>c. Preventive Maintenance:</u> Responsibility for maintenance is negotiable, and it can impact performance. Clarify how long-term preventive maintenance will be assured, especially if the party responsible for long-term performance is not responsible for maintenance (e.g., Contractor provides maintenance checklist and reporting frequency). Clarify who is responsible for long-term preventive maintenance to maintain operational performance throughout the Contract term. Clarify what will be done if inadequate preventive maintenance impacts performance.</p>		
<p><u>d. Equipment Repair and Replacement:</u> Responsibility for repair and replacement of Contractor-installed equipment is negotiable, however it is often tied to project performance. Clarify who is responsible for replacement of failed components or equipment throughout the term of the Contract. Specifically address potential impacts on performance due to equipment failure. Specify expected equipment life and warranties for all installed equipment. Discuss replacement responsibility when equipment life is shorter than the term of the Contract.</p>		

APPENDIX C-APS ISG TEST PLAN

APS ISG Test Plan APS Proposed Testing Rev – 7:06 am - 3/6/06

1) Purpose

The purpose of this test is to determine the function and efficiency of the ISG Solar PVPC unit. This test will be two phases and has the following objectives.

2) Test Objectives

a) Phase 1 – Functional Test

- ISG Component General Functional Test
 - Component charges batteries as battery manufactures require.
 - ISG Component Environmental Operation Test

b) Phase 2 - Component Efficiency Test

- Instantaneous evaluation of the component efficiency at varying light levels.
- Comparative test of the ISG system to the Outback MPPT charge controller (APS supplied). Test to be done over time (1 month of operation).
- Above tests can be checked by using one module for control, 4 modules for ISG systems and 4 modules for Outback MPPT.

3) Test Equipment

- Fluke 87 meter
- Fluke 43 recording meter
- Campbell Scientific DAS

4) DAS Design – Phase 1

The DAS is a Campbell Scientific CR10x. It will take 10 minute average, max and min data. It has the following inputs. If this does not give the resolution we need, the time interval will be reduced.

Description	Sensor Type
4 Panel ISG Current Output	Shunt – 30A/50mV
4 Panel Current Input to Outback	Shunt– 30A/50mV
Outback Current Output	Shunt– 20A/50mV
DC Battery Bus Voltage	Voltage Divider – 1:7
POA irradiance Sensor	MSX01
DC Current Input to Inverter	Shunt – 400A/50mV

The system's load will be fairly steady, an utility grade service meter will be used to track the AC system output. This meter can be manually read periodically to be used as a check against the DC battery output readings.

5) Establish System Control

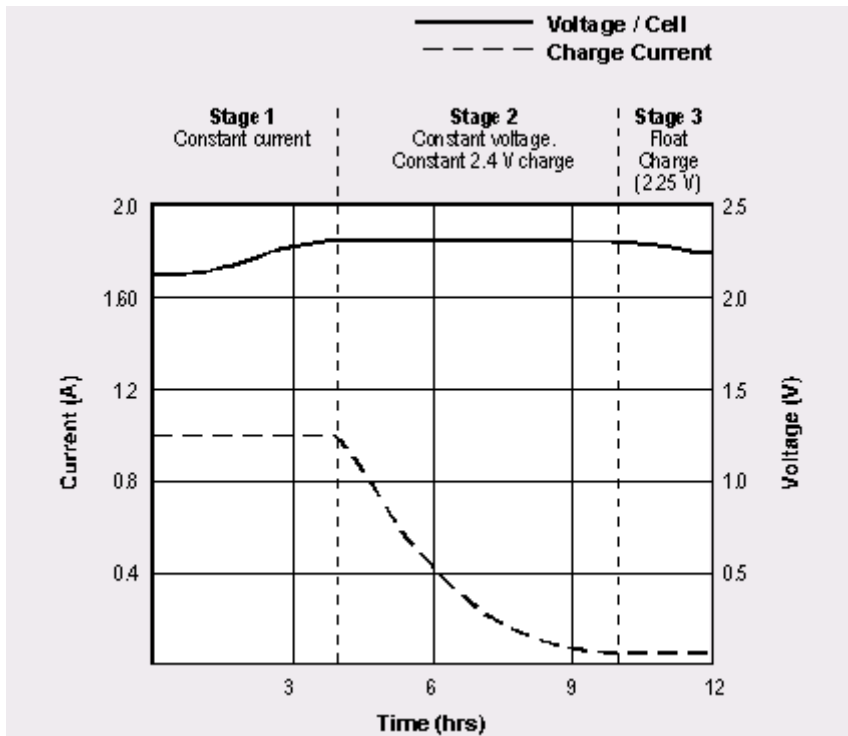
Because the ISG test is a comparison of the ISG component compared to a standard Outback MPPT battery charger. To reduce the difference between the two converters, the batteries, inverters and AC load will be shared. In addition, both converter approaches will have the same number of PV modules of the same make, model and manufacturing lot. To make sure these modules are producing the same power, IV curves will be taken and compared. One spare module will be available if one module is out of specification. Below is the procedure for the IV corrections.

- a) IV curves will be taken for all modules at high insulation levels by APS.
- b) The curves will be compared to determine the differences.
- c) Any module with more than 3% difference will be replaced with the spare.

6) Testing – Phase 1

This test is the functional test to check the ISG converters ability to correctly operate as a battery charger. Below is an outline of the test.

- a) Battery Protection Test – The purpose for this test is to check the operation of the ISG battery charger and determine whether the batteries will be protected. Below are the major steps of this test.
 - i) Review ISG battery charging set points.
 - ii) Start with the batteries fully charged.
 - iii) Disconnect the Outback Charger and the load.
 - iv) Connect the fluke 43 to the DC bus in record mode.
 - v) Start charging the batteries with the ISG charger.
 - vi) The batteries will be left connected to the ISG controlled PV to determine if it follows the chart below.



-Note that the battery voltage should not climb above 2.4V per cell.

- vii) The batteries will be charged for 3 days. Periodically, APS will check the battery voltage to determine if it is following the voltage chart above. After the 3 day period, APS will save the voltage chart and determine if it is correctly charging the batteries. This chart will be shared with ISG with our analysis.
 - viii) This test can be repeated if the battery charging is not in accordance with the chart above.
 - ix) Data Analysis – The Fluke 43 data will be the only data used for this test. All analysis will be done by a brief review of the charts by APS staff.
- b) Full Battery Charging Test – This battery charging test will be a full test of the ISG component's ability to charge batteries in a cycling operation. The second half of this test will be testing the operation of the Outback charger in parallel
- i) Both charge circuits are disconnected from the battery.
 - ii) Place a load on the battery to discharge them to the LVCO of the inverter.
 - iii) Connect the Fluke 43 to the battery to record voltage. Place the fluke in record mode.

- iv) Connect the ISG charge circuit to the batteries. Allow the batteries to fully charge.
 - v) Record the battery charging. Save the charge graph. If the batteries are charged in accordance with the chart in the battery protection test.
 - vi) Turn on a 200-300 watt load to discharge the batteries.
 - vii) Disconnect the load after the batteries are discharged and record the charging using the CS DAS.
 - viii) Repeat discharge 2 times.
 - ix) Data Analysis - APS will download the CS DAS. This data will be given to ISG. ISG will need to produce a graph overlaying the battery charging current and voltage. ISG and APS will give separate reviews of the charging.
- c) Parallel Battery Charging Test
- i) Discharge batteries.
 - ii) Connect both battery chargers.
 - iii) Check parallel operation of Outback & ISG
 - iv) Record the operation.
 - v) Repeat i) through ii) two times.
 - vi) Data Analysis – APS will download the data. This data will be given to ISG to produce graphs showing battery voltage and charging currents of both circuits on the same graph. APS and ISG will then review the data to determine if any interaction exists.
- d) Long Term Testing – The next phase of this test is the long term operational test of the ISG equipment. This test will take 1 month. Some of this data will be used for the performance portion of the testing in phase 2.
- i) Connect both battery charging circuits.
 - ii) Connect 100W load.
 - iii) Leave operating for long-term test.
 - iv) The system will be checked daily for battery voltage and load operation. If the load is not big enough to exercise the batteries in a full range, a larger load will be added. A log will be kept of all actions taken by APS.
 - v) Download data after 1 week. Produce graphs and make sure the data is being collected correctly. Perform initial analysis.
 - vi) After 1 month, the data will be downloaded. ISG will chart the data. This will be reviewed by both APS and ISG.
- e) Analysis – Go/No Go review
- i) The analysis for this phase of testing will be a two page report discussing the ISG components ability to charge batteries and functionally operate as reflected by the 4 tests. In addition, APS will provide a critique of the battery charging and record any events. If the

ISG converter operates in a manner which protects the batteries, the phase 2 test will begin.

7) Phase 2 Test – Performance Evaluation

- a) Short-term Efficiency Evaluation – This test will be done to determine the components efficiency at varying light levels.
 - i) The batteries will be partially discharged and a small load will be placed on the system.
 - ii) On a clear day, both charging circuits will be connected.
 - iii) Using a fluke 87, periodic (hourly) input/output voltage and current checks will be recorded manually for both charger types.
 - iv) APS will share this data. Both APS and ISG will calculate the efficiency.
- b) Comparative test of the ISG system to the Outback MPPT charge controller (APS supplied). Test to be done over time (1 month of operation).
 - i) A load will be placed on the system.
 - ii) Both charger circuits will be connected to the battery.
 - iii) Periodically, APS will check the system to make sure it is operating correctly.
 - iv) Download data after 1 week. Produce graphs and make sure the data is being collected correctly. Perform initial analysis.
 - v) Data Analysis - After 1 month, APS will download the data. APS will give this data to ISG. Both APS and ISG will analyze it to calculate the energy production of each circuit. This energy production for each will be compared to each other.
- c) Final Report – The report for this test will outline the approach and findings. This will be several pages long.

8) Lessons learned and Go/No Go Analysis

APS will perform an analysis of the testing and the findings. Lessons learned will be reviewed and recorded as well as an analysis of the APS view of the technology from an operational standpoint. In addition, a review from a go/no go stand point will be done and reported to APS management.

9) Final Report

Final report will be a combination of the two reports, the lessons learned review and an executive summary.

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